

# POPULAR SCIENCE

25¢  
FEB



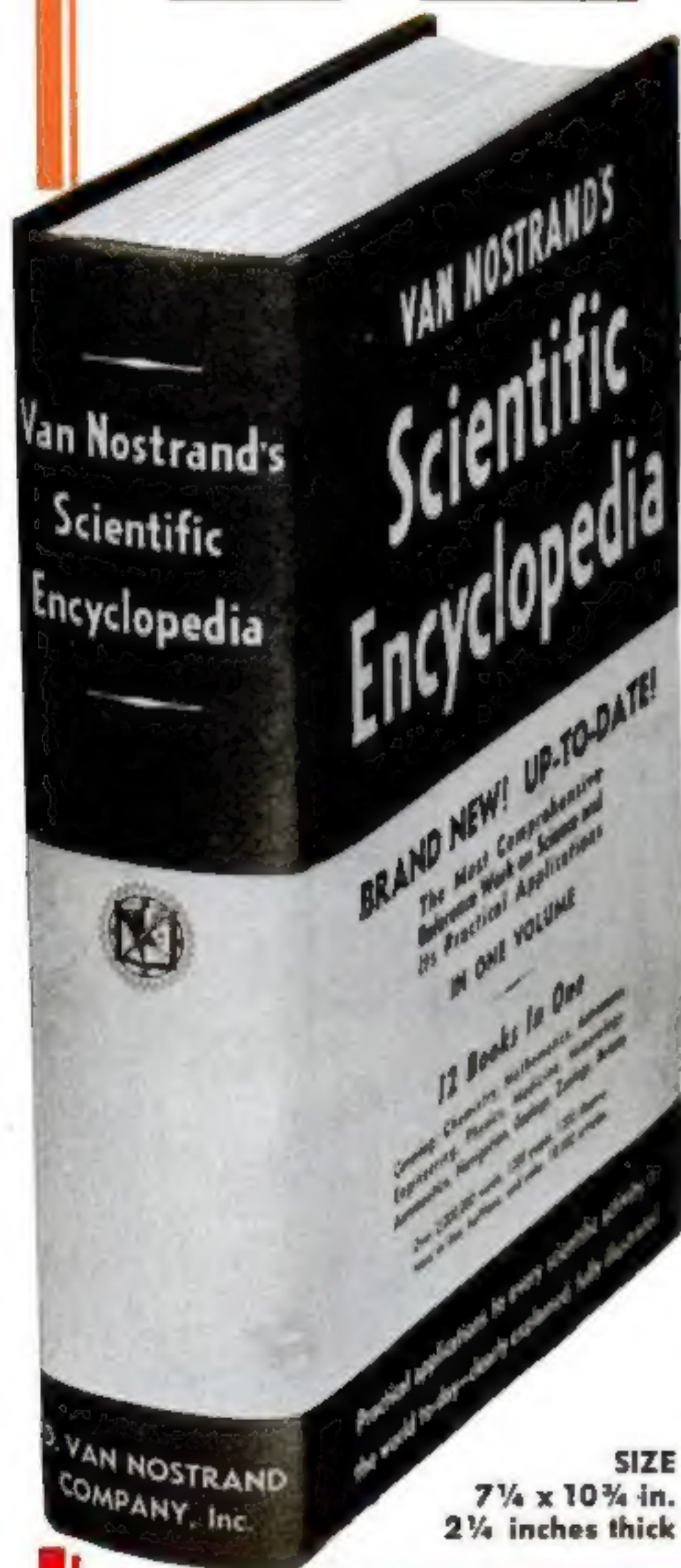
WHAT IS THE TRUTH ABOUT AMERICA'S WAR GLIDERS?

PG.  
94



# All the Sciences

**1500 Pages**  
**1200 Illustrations**



**SIZE**  
**7 1/4 x 10 3/4 in.**  
**2 1/4 inches thick**

**T**HIS great new work presents—for the first time in one volume—a complete coverage of the terms of science and engineering. Principles are clearly explained—methods of calculation are fully described with the formulae and units—chemical structures and reactions, physical laws and instruments, engineering design, construction, and operation are merely suggestive of its tremendous scope—which extends throughout the entire range of technical knowledge up to the most recent advances and inventions. The great number of photographs, diagrams, and charts have been specially prepared and selected to show the salient facts most clearly. Innumerable tables and summaries make all this information easily available for instant reference. This vast fund of information has been prepared and organized by a plan that insures its usefulness, completeness, and accuracy. Each entry is first explained in simple, broad terms that are easy to understand, and that serve as an illuminating introduction to the detailed and more advanced information which follows.

## **From Fundamentals to Latest Advanced Discoveries—**

**Principles, Methods, Formulae—Clear Charts, Diagrams**

**F**OR the student, the hobbyist, the manual worker, this great volume supplies, for the first time, a single, convenient source of reference covering all the sciences. The ample cross-references make it easy to follow a complete course of study on any chosen subject. By this flexible plan of arrangement, the professional scientist, who wants specific information instantly, either in his own field or any related field, can find it in a few seconds in its alphabetical place—comprehensively treated in the language he works with—the language of science.

## **The Instant Question-Answerer for Laboratory and Shop Workers, Mechanics, Home Scientists, Students**

Answers tens of thousands of questions such as: The value of radial, rotary gas engines—How the Diesel Engine operates—How air conditioning functions—What is the coming television system—How storage batteries work—How to find your position at sea—How to do dead reckoning—How your nervous system works—How to recognize every star, planet, constellation—How optical instruments are constructed—How to work arithmetic, algebra, geometry problems—How bridges are constructed—How an airplane beacon system works—How petroleum is cracked to make gasoline—How rayon is made—How to survey a piece of land—and thousands more.

(Continued on facing page)



# in One Great Book

## 10,000 Separate Subjects Twelve Big Volumes in One

(continued from facing cover)

The vast wealth of useful information in the Scientific Encyclopedia, if published in the ordinary way, would fill more than 12 average-size volumes. Here is just a brief outline of some of the subjects covered:

**CHEMISTRY:** Chemical elements—symbols, atomic number, atomic weight, density, hardness, melting point, etc.—common reactions, occurrence in nature, method of production from ores, uses in industry. Compounds—full information, including manufacture and use. Organic compounds; industrial products. Agricultural chemistry, food chemistry.

**PHYSICS:** Mechanics, heat, light, sound, electricity, magnetism, X-rays, fully covered; principles and application profusely illustrated.

**MATHEMATICS:** From fundamentals of arithmetic to algebra, geometry, trigonometry, calculus, differential equations, etc.; with special emphasis on their application to science.

**ASTRONOMY:** Articles cover the entire subject. Each important constellation is shown on a star map so that it can be easily located in the sky. Complete information on planets, use of telescope, spectrometer, etc.

**ZOOLOGY:** The whole story of life from the tiniest single-celled organisms up to man himself, including vast numbers of common insects, mollusks, worms; birds, fish, reptiles, mammals.

**MEDICINE:** Thorough coverage of anatomy, circulatory system, nervous system, muscular system, skeletal system, excretory systems, etc. Vitamins, hormones. Bacteriology. Diseases—symptoms, diagnosis, treatment. Drugs. Latest researches and findings.

**MECHANICAL ENGINEERING:** Principles of mechanics, machine design, engineering parts and instruments. Types and functions of bolts, cams, gears, and other fundamentals up to automobiles, aeroplanes, locomotives, etc. Steam, gas, gasoline, diesel engines.

**CIVIL ENGINEERING:** Surveying. Bridges, highways, railways—every subject thoroughly explained.

**ELECTRICAL ENGINEERING:** Motors, generators, lighting, radio and television—every branch fully covered and clearly illustrated.

The foregoing is only a partial list of the countless special subjects covered. You will find hundreds of articles on GEOLOGY, BOTANY, NAVIGATION, CHEMICAL ENGINEERING, and, in fact, any special branch of science in which you want information.

### EXAMINE A COPY FREE

It is difficult in this limited space to give you a complete adequate idea of the immense amount of material contained in the Scientific Encyclopedia. See this volume for yourself, without expense or obligation. We will send it to you for free examination. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N.Y.

### Prepared by Outstanding Authorities in Each Field of Science

The high technical standing of the editors is your assurance of the authoritativeness and accuracy of every statement. Although the responsibility for each subject was in the hands of a single noted scientist, the authors and publishers have had the co-operation and advice of a large group of well-known authorities.

### CONTRIBUTING EDITORS

<b>GEOLOGY</b>	
RICHARD M. FIELD, Ph.D.	Princeton University
<b>ASTRONOMY AND NAVIGATION</b>	
WARREN K. CHEN, Ph.D.	Amherst College
<b>ZOOLOGY</b>	
ARTHUR W. LINDSEY, Ph.D.	Dartmouth University
<b>ENGINEERING AND AERONAUTICS</b>	
FREDERICK T. MOUSE, M.Sc., E.E.	University of Virginia
<b>MEDICINE</b>	
R. S. MUELLER, M.D.	Columbia University
<b>MATHEMATICS</b>	
LLOYD L. SMITH, Ph.D.	Lakewood University
<b>MINERALOGY</b>	
EDWARD S. C. SMITH, B.Sc., A.M.	Union College
<b>CHEMISTRY</b>	
RALPH S. STRONG, Ph.D.	Rensselaer Polytechnic Institute
<b>PHYSICS</b>	
LEROY D. WELD, Ph.D.	Coe College
<b>BOTANY</b>	
R. M. WHELDON, Ph.D.	Massachusetts Institute of Technology

Among the many

### CONSULTING EDITORS

ROBERT H. BAKER, Ph.D., D.Sc.	University of Illinois
HENRY STAD CASTLE, Ph.D.	Yale University
C. W. CUNNINGHAM, B.Sc.	College of the City of New York
HERBERT O. ELFTMAN, Ph.D.	Columbia University
ERICH HAUSEMAN, E.E., Sc.D.	Polytechnic Inst. of Brooklyn
ADOLF KNOPP, Ph.D.	Yale University
JOHN C. RATHBUN, Ph.D.	College of the City of New York
EDGAR P. SLACK, B.Sc.	Polytechnic Institute of Brooklyn
HUGH S. TAYLOR, D.Sc., F.R.S.	Princeton University
JOHN TURKEVICH, Ph.D.	Princeton University
VOLNEY H. WELLS, Ph.D.	Williams College

### MAIL THIS COUPON

Send No Money Now Unless You Wish To

D. VAN NOSTRAND CO., Inc.  
250 Fourth Avenue, New York 3, N. Y.  
Send me Van Nostrand's SCIENTIFIC ENCYCLOPEDIA, complete in one volume, 1500 pages, bound in Sturdy Fabrikoid. Within 10 days I will either return it or send you \$2.00 as first payment, and \$2.00 monthly for four months thereafter. (P.S.M. 2-44)

Name .....

Address .....

City and State .....

Reference .....

Address .....



# Your Long Distance call may have gone to New Guinea

Telephone lines are the life-lines of an army. Bell System men and materials are helping to keep those lines unbroken on many battlefronts.

So if a Long Distance call gets delayed once in a while, you know there's a good reason.

The additional equipment that could be used here is serving the soldiers over there.

**BELL TELEPHONE SYSTEM**



*U. S. Army Signal Corps installing switchboard in New Guinea*

**WAR NEEDS  
THE WIRES**

If the Long Distance circuit you want is busy — and your call isn't really urgent — it will help if you will cancel it.

If it must go through, we'll appreciate your co-operation when the operator says: "Please limit your call to 5 minutes."







## "Tell Tojo for me . . . I'm the guy who proved we could make synthetic tires"

"I did it long before Pearl Harbor, too—in that B. F. Goodrich 80,000,000-mile road test"

"Nope," said the Private on post number 4, "the tires I tested weren't the tires you're driving today. They were passenger car tires—and they had synthetic in 'em all right. They were the first such tires ever sold and put out on actual road test in America."

"B. F. Goodrich made 'em. Over half the natural rubber was replaced by their synthetic—Ameripol. I bought a set."

So did hundreds of others. Together we rolled up 80,000,000 miles. I'm glad I made that test. Gives me a feeling of confidence when I see B. F. Goodrich synthetic tires coming through on these bug-gies!"

Today's B. F. Goodrich passenger car tires are made with Government synthetic—"GR-S." And more than 99% of the natural rubber has been replaced by it.

But the big thing gained in the 80,000,000-mile road test was "know-how." This three-year head start has already

enabled us to produce a synthetic passenger car tire almost as good as a pre-war Silver-town . . . and it's the best synthetic tire you can buy today.

If you need tires, and can qualify, you may be able to buy a B. F. Goodrich synthetic Silvertown. But remember, please, the Army and Navy still need all the rubber they can get. Do everything you can to save your tires—and don't drive a single needless mile. The B. F. Goodrich Co., Akron, O.



Awards to 8 plants





# POPULAR SCIENCE

FOUNDED 1872

MONTHLY

VOL. 144 NO. 1

Mechanics & Handicraft

A TECHNICAL JOURNAL OF SCIENCE AND INDUSTRY

## CONTENTS for FEBRUARY, 1944

Cover: Painting by Jo Kotula

### News

Making Our Soldiers Tough Enough	57
Burma Is No Paradise.....	63
I Fly "Mitchells".....	70
Shields for Sky Fighters.....	74
1001 Postwar Jobs for the Jeep.....	80
Knot-Tying Obstacle Race.....	86
He Got Action!.....	88
The Flags of Our Allies.....	92
Silent Partner of the Plane.....	94
Daily Workout Guards Your Health....	103
Flying Big Gun.....	105
Dynamite Saves Crankshafts.....	110
How Binoculars Are Made.....	114
Are Your Eyes Right?.....	120
Sound—New Wartime Tonic.....	126

### Automobiles

Testing with a Voltmeter.....	134
Gus Finds Trouble in Bubbles.....	138
Retreads Woven on a Carpet Loom....	141

### Home and Workshop

Wooden Bowl Used in Novel Stand....	143
Cabinet Has Swinging Drawers.....	144
Pinball Game Scored in Reverse.....	146
Music Stand Serves Dual Purpose.....	148
Making Joints with Hand Tools.....	152
Model of First Liberty Ship.....	156
Spark Coil Lights Welding Torch.....	161
Turning Tapers on a Lathe.....	162
First Aid for Sick Plumbing.....	170

## P.S.M. NOW 25c

**I**F YOU bought your copy of this issue of POPULAR SCIENCE on the newsstand, it cost you a quarter. As announced last month, the change of price is forced upon us by greatly increased costs of paper, printing, and labor. We feel, however, that we are now giving our readers more for their money than ever before. An example is the increased use of color, with many pages of paintings and color photographs in a high quality of reproduction that makes them suitable for framing or pin-ups. Inaugurated in our January issue, this is a regular feature you can look forward to monthly.

EDITOR . . . . . Charles McLendon  
ASSISTANT EDITOR . . . . . Arthur Wakeling  
AVIATION EDITOR . . . . . C. B. Calby  
HOME & WORKSHOP EDITOR . . . . . Harry Walton  
ART EDITOR . . . . . Carsten Granda

EDITORIAL ASSOCIATES: Fred O. Newman, news editor; Alden P. Armagnac, B. T. Richards, Harry Samuels, Michela de Santis, Don Romero, Jack O'Brien, Jean Ackermann, Frank Rowlands, Jr., Carl W. Bertsch, Edward M. Collins, Ruth Westphal.

ART ASSOCIATES: Stewart Reese, William Patrick, Samuel Dukler, Evelyn Cooper.

PHOTOGRAPHY: W. W. Morris, Robert F. Smith.

Published monthly at 353 Fourth Avenue, New York 10, N. Y., by Popular Science Publishing Co., Inc. Godfrey Hammond, President and Treasurer; R. C. Wilson, Raymond J. Brown, Charles McLendon, Stephen P. Glendon, Vice-Presidents; F. W. Briggs, Secretary. Entered as second-class matter Dec. 26, 1915, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U.S.A. Copyright, 1943, by Popular Science Publishing Co., Inc. All rights reserved in the United States, Great Britain, and in all countries participating in the International Copyright Convention and the Pan American Copyright Convention. Yearly subscriptions to United States and its possessions, \$2.00; Canada, \$2.50; foreign countries, excepting Canada, \$3.00. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address.



# What will be **YOUR** place in the new world

Victory will find us in a new world of electronics, synthetics, plastics, light metals, prefabricated buildings, high-octane gasoline — thousands of new industrial developments.

Look ahead to your place in the era of production marvels. Don't be satisfied to slide along in the same old groove while ambitious fellow-workers prepare to take over the top positions and the top rewards.

Far-sightedness is one of the requisites of leadership. Those possessing it are acting *today* to be qualified as *trained men* when tomorrow comes. They are mastering I. C. S. Courses **NOW!**

The cost of I. C. S. training is just a few dollars monthly. Mark your interest in the list of courses and mail the coupon for complete information on I. C. S. advantages *right now!* This can be the *turning point* of your career!



## INTERNATIONAL CORRESPONDENCE SCHOOLS

HELPING TO TRAIN AMERICANS FOR VICTORY

BOX 7670-K, SCRANTON 9, PENNA.

Without cost or obligation, please send me booklet and full particulars about the course *before* which I have marked X:

SPECIAL  
TUITION RATES  
FOR MEMBERS  
OF THE  
ARMED FORCES



- |   |  |   |   |
|---|--|---|---|
| <input type="checkbox"/> Air Brakes<br><input type="checkbox"/> Air Conditioning<br><input type="checkbox"/> Airplane Drafting<br><input type="checkbox"/> Architectural Drafting<br><input type="checkbox"/> Architecture<br><input type="checkbox"/> Auto Engine Tune-up<br><input type="checkbox"/> Auto Technician<br><input type="checkbox"/> Aviation <input type="checkbox"/> Aviation Mechanics<br><input type="checkbox"/> Blueprint Reading<br><input type="checkbox"/> Boilermaking<br><input type="checkbox"/> Bridge Engineering<br><input type="checkbox"/> Chemistry <input type="checkbox"/> Coal Mining<br><input type="checkbox"/> Civil Engineering<br><input type="checkbox"/> Concrete Engineering | <input type="checkbox"/> Contracting and Building<br><input type="checkbox"/> Cotton Manufacturing<br><input type="checkbox"/> Diesel Engines<br><input type="checkbox"/> Electrical Drafting<br><input type="checkbox"/> Electrical Engineering<br><input type="checkbox"/> Electrician<br><input type="checkbox"/> Electrical Maintenance<br><input type="checkbox"/> Foundryman <input type="checkbox"/> Heating<br><input type="checkbox"/> Heat Treatment of Metals<br><input type="checkbox"/> Highway Engineering<br><input type="checkbox"/> House Planning<br><input type="checkbox"/> Industrial Metallurgy<br><input type="checkbox"/> Locomotive Engineer<br><input type="checkbox"/> Machinist <input type="checkbox"/> Inspector | <input type="checkbox"/> Management of Inventories<br><input type="checkbox"/> Marine Engines<br><input type="checkbox"/> Mechanical Drafting<br><input type="checkbox"/> Mechanical Engineering<br><input type="checkbox"/> Mine Foreman<br><input type="checkbox"/> Navigation <input type="checkbox"/> Patternmaking<br><input type="checkbox"/> Plastics <input type="checkbox"/> Plumbing<br><input type="checkbox"/> Public Works Engineering<br><input type="checkbox"/> Pulp and Paper Making<br><input type="checkbox"/> Radio, General<br><input type="checkbox"/> Radio Operating<br><input type="checkbox"/> Radio Servicing<br><input type="checkbox"/> R. R. Section Foreman<br><input type="checkbox"/> R. R. Signaller <input type="checkbox"/> Refrigeration | <input type="checkbox"/> Sanitary Engineering<br><input type="checkbox"/> Sheet Metal Work<br><input type="checkbox"/> Ship Drafting<br><input type="checkbox"/> Shipfitting <input type="checkbox"/> Shop Practice<br><input type="checkbox"/> Steam Electric <input type="checkbox"/> Steam Engines<br><input type="checkbox"/> Steam Fitting<br><input type="checkbox"/> Structural Drafting<br><input type="checkbox"/> Structural Engineering<br><input type="checkbox"/> Surveying and Mapping<br><input type="checkbox"/> Telegraphy <input type="checkbox"/> Telephony<br><input type="checkbox"/> Textile Designing<br><input type="checkbox"/> Toolmaking <input type="checkbox"/> Tool Design<br><input type="checkbox"/> Welding, Gas and Electric<br><input type="checkbox"/> Woolen Manufacturing |
| <input type="checkbox"/> Accounting <input type="checkbox"/> Advertising<br><input type="checkbox"/> Bookkeeping<br><input type="checkbox"/> Business Correspondence<br><input type="checkbox"/> Business Management<br><input type="checkbox"/> Cartooning <input type="checkbox"/> Civil Service  | <input type="checkbox"/> College Preparatory<br><input type="checkbox"/> Commercial<br><input type="checkbox"/> Commercial Illustrating<br><input type="checkbox"/> Cost Accounting<br><input type="checkbox"/> C. P. Accounting   | <b>BUSINESS COURSES</b><br><input type="checkbox"/> Federal Tax Course<br><input type="checkbox"/> First Year College<br><input type="checkbox"/> Foremanship <input type="checkbox"/> French<br><input type="checkbox"/> Good English <input type="checkbox"/> High School<br><input type="checkbox"/> Managing Men at Work  | <input type="checkbox"/> Railway Postal Clerk<br><input type="checkbox"/> Salesmanship<br><input type="checkbox"/> Secretarial <input type="checkbox"/> Spanish<br><input type="checkbox"/> Showcard and Sign Lettering<br><input type="checkbox"/> Traffic Management  |
| <b>HOME ECONOMICS COURSES</b><br><input type="checkbox"/> Advanced Dressmaking<br><input type="checkbox"/> Home Dressmaking<br><input type="checkbox"/> Foods and Cookery<br><input type="checkbox"/> Professional Dressmaking and Designing<br><input type="checkbox"/> Tea Room and Cafeteria Management, Catering  |  |   |   |

Name..... Age..... Home Address.....  
 City..... State..... Present Position.....

Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada,  
 British residents send coupon to I. C. S., 71 Kingway, London, W. O. 2, England.



# Contents [CONTINUED]

## Craftwork

Ship Weather Vane Is Realistic.....	147
Gaily Finished Table Wheelbarrow.....	147
Chip Carving Adorns Jewel Box.....	150
Mirrors Cover Picture Case.....	151
Whittling a Ball-and-Cap Gun.....	151
Two-in-One Wardrobe Accessories.....	158
Sand-Pile Toys for Children.....	159

## Electrical

Resistance-coupled Amplifiers.....	182
Two-Pentode Amplifier Hookup.....	185
Curing Faulty Radio Reception.....	186
Power Pack for Plate Current.....	187

## Miscellaneous

Aids to Modern Living.....	132
Emergency Sled Made from Boughs.....	175
Bird House Built from Pail.....	175
Experiments with Heat and Flame.....	188
Catalytic Action in Chemistry.....	190
Blowing Giant Soap Bubbles.....	193
New Ideas for Home Owners.....	196
Overhauling Corn Planters.....	198

## New Shop Ideas

Flame-Cutting Heavy Tubing.....	166
Rack Holds Many Templates.....	166

## Photography

New Home Movies from Old.....	176
Hints for Camera Users.....	180

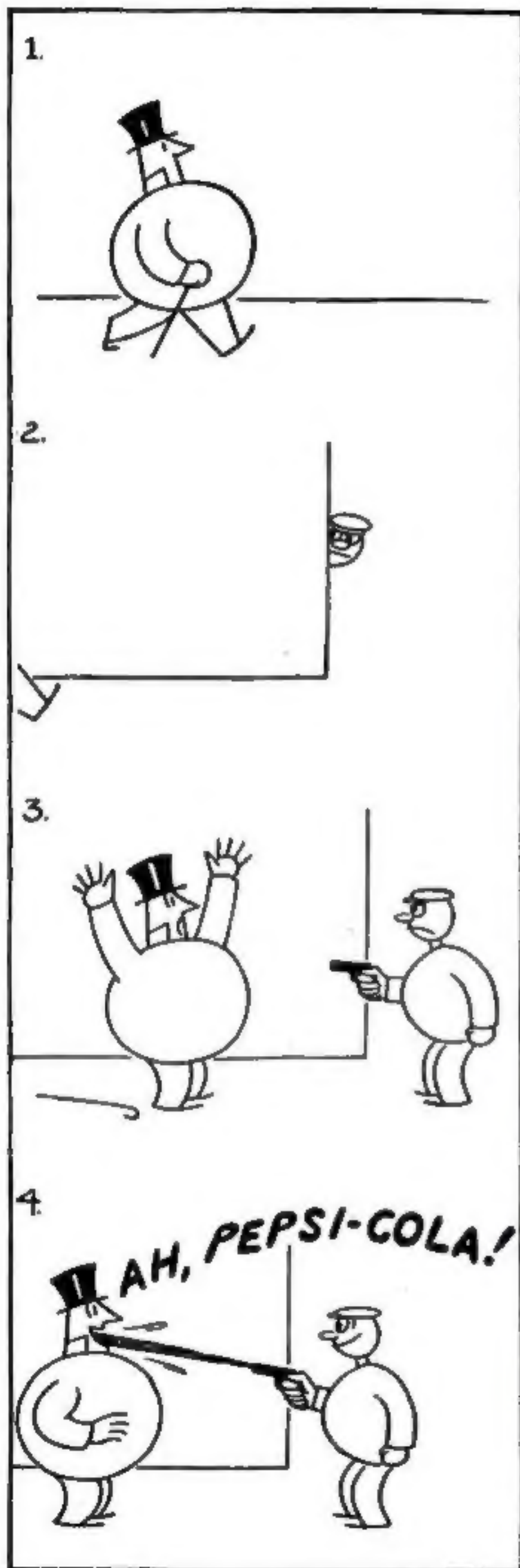
## Shop Data File

Cutting Hip and Valley Rafters.....	145
House Check List for February.....	200

## Woodworking

Tilting Jig for Circular Saw.....	155
Circular Chair for the Bedroom.....	194
Back Rest for Reading in Bed.....	197

**IMPORTANT NOTICE:** The contents of this magazine must not be reprinted without permission. The editors are not responsible for unsolicited contributions, and cannot guarantee the return of such material or insure against its loss. Contributions not accompanied by sufficient postage will not be returned. In presenting numerous stories of new products of applied science, Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. To avoid liability for patent infringement, readers should investigate before making, using, or offering for sale any of the devices, machines, or processes described. Popular Science Monthly takes no responsibility. The use of Popular Science Monthly articles for stock-selling schemes is never authorized.





"SWEETHEART," HE SAID SOFTLY, "THEY  
COULDN'T KILL A GAL LIKE YOU..." He touched  
 the tank tender-like. Nazi shells had ripped into  
 her heart... You'd think she would have died with two-  
 fifths of her engine knocked out... but she didn't!...  
 she kept rolling along as though  
 nothing could stop her.



NOW, the heart of that General Sherman tank was not one engine... but  
 five, hooked together... and all five are the same six-cylinder jobs you have in your  
 Chrysler. These engines can run on their sides... on their backs. And even when two are  
 destroyed by enemy fire, the other three can keep the tank rolling. You can credit  
 Chrysler Division "know-how"... and an alert U. S. Ordnance Department for this one.

WAR PRODUCTS OF CHRYSLER DIVISION  
 Industrial Engines • Marine Engines • Marine  
 Tractors • Navy Pumps • Harbor Tugs •  
 Anti-Aircraft Cannon Parts • Tank Engine  
 Assemblies • Tank Parts • Airplane Wing  
 Panels • Fire-Fighting Equipment • Air Raid  
 Sirens • Gun Boats • Searchlight Reflectors.

**CHRYSLER**



DIVISION OF CHRYSLER CORPORATION

BACK THE ATTACK WITH WAR BONDS!

THE NATION-WIDE CHRYSLER DEALER ORGANIZATION OFFERS OWNERS SERVICE FACILITIES TO MEET THEIR TRANSPORTATION NEEDS

FEBRUARY, 1944

Buy War Savings Bonds and Stamps regularly.

7



## WHAT'S IN A NAME?



EMILY  
means "a mother"

FRANK  
means "free"

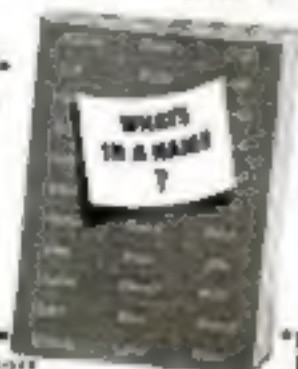
You'll be surprised at the meanings of some of your friends' names. Have fun looking them up in "WHAT'S IN A NAME?" — the new cartoon-illustrated book that everybody's talking about.

The Ethyl Corporation would like to send you this fascinating booklet *free* because we think it will help you to remember our name and what it means:

"ETHYL is a *trade mark* name. It stands for antiknock fluid made only by the Ethyl Corporation. Our war job is manufacturing this fluid for improving fighting gasoline."



**FREE** COLOR-ILLUSTRATED BOOK GIVES MEANINGS OF OVER 500 MEN'S AND WOMEN'S NAMES. JUST SEND COUPON—NO MONEY—NO OBLIGATION OF ANY SORT.



"WHAT'S IN A NAME?"

Dept. H16, Box 53, New York 8, N.Y.

Please send me a free copy of "What's in a Name?"

Name.....  
(PLEASE PRINT)

Address.....

City & State.....

## Coming Next Month

**SEAT-OF-THE-PANTS** flying is out when you pilot a modern bomber or fighter. The skipper of a warplane needs all the mechanical help he can get—and he gets plenty from a bewildering array of precision instruments whose dials tell him countless details of the performance of his ship. What these instruments are and how they work is the subject of an authoritative article by James L. H. Peck.

**THE HUMBLE RIVET** has a big place in the building of warplanes. Wings, engines, and guns would be useless without the tiny stitches of metal that hold the ship together. Have you ever wondered how rivets are turned out by the millions for our aircraft building program? It's all told in words and pictures.

**MICROSCOPY** is not a closed field to hobbyist beginners, in spite of the wartime scarcity of instruments for nonessential use. Morton C. Walling tells you how to build your own compound microscope, complete with features usually found only on professional equipment. Lenses and other material are inexpensive and easily obtained.

**DO YOU KNOW** the insignia that identify the warplanes of the United Nations and other air powers? These battle markings will be shown in full color in a display that is only one of many brilliantly reproduced features worthy of a permanent place on your walls.

**AIDS TO NAVIGATION** are the mariner's road markers—the lighthouses, buoys, bells, and other signaling devices that show seamen the way to their ports and warn them of hidden dangers. Albert Q. Maisel describes these faithful lifesavers and tells how they are maintained in peace and war.

**CAMERA PORTRAITS** in the Hollywood manner need not be the despair of the amateur lensman. Your guide to better portraits is Maurine, whose art has lifted her from a stand-in's job to top rank among the still-picture makers of the movie capital. Her helpful advice covers camera, lighting, and make-up of the sitter.

Buy War Savings Bonds and Stamps regularly.

## Model Builders Attention!



Actual Size V-Plug

Champion spark plugs for model gas engines give the same dependable performance as their larger counterparts. Silliment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One-piece construction.

**CHAMPION**

SPARK PLUG COMPANY

TOLEDO, OHIO

	V	V-2	V-3
Hex	1/2"	3/8"	3/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2



# INTERNATIONAL CORRESPONDENCE SCHOOLS

OFFER YOU LOW-COST

# SPECIAL TRAINING

FOR SUCCESS IN MODERN  
BUSINESS AND INDUSTRY

## TECHNICAL COURSES

### Air Conditioning Schools

Air Conditioning  
Heating  
Plumbing  
Refrigeration  
Steam Fitting

### Chemistry Schools

Chemical Engineering  
Chemistry, Analytical  
Chemistry, Industrial  
Chemistry,  
Mfg. Iron and Steel  
Pulp and Paper Making

### Civil, Architectural and Structural Engineering Schools

Architecture  
Architectural Drafting  
Bridge and Building  
Foreman  
Bridge Engineering  
Building Estimating  
Civil Engineering  
Concrete Engineering  
Contracting and Building  
Highway Engineering  
Retail Lumbermen  
Structural Drafting  
Structural Engineering  
Surveying and Mapping

### Electrical Schools

Electrical Engineering  
Electric Wiring  
Gas and Electric Welding  
Industrial Electrician  
Lighting Technician

Power House  
Practical Telephony  
Radio, General  
Radio Operating  
Radio Servicing  
Telegraph Engineering

### Internal Combustion Engines Schools

Automobile Technician  
Aviation  
Diesel-Electric  
Diesel Engines  
Gas Engines

### Mechanical Schools

Airplane Drafting  
Foundry Work  
Heat Treatment of Metals  
Inventing and Patenting  
Machine Shop Practice  
Mechanical Drafting  
Mechanical Engineering  
Metal Pattern Drafting  
Mold Loft Work  
Reading Shop Blueprints  
Sheet Metal Worker  
Ship Drafting  
Ship Fitting  
Shop Practice  
Steel Mill Workers  
Tool Designing  
Wood Pattern Making

### Railroad Courses

Air Brake  
Car Inspector  
Locomotive Engineer  
Locomotive Fireman  
Railroad Car Repairer  
Railroad Section Foreman

### Steam Engineering Schools

Boiler Making  
Combustion Engineering  
Engine Running  
Marine Engines  
Petroleum Refining Plant

### Steam Electric Steam Engines

### Textile Schools

Cotton Manufacturing  
Textile Designing  
Woolen Manufacturing

## BUSINESS and ACADEMIC COURSES

### Academic Schools

Arithmetic  
College Preparatory  
First Year College  
High School  
Higher Mathematics  
Illustrating

### Business Schools

Accounting  
Advertising  
Bookkeeping  
Business Correspondence  
Business Management  
Cert. Pub. Accounting  
Commercial

Cost Accounting  
Foremanship  
Salesmanship  
Secretarial  
Stenography  
Traffic Management

### Civil Service Schools

City Letter Carrier  
Post Office Clerk  
Railway Postal Clerk

### Language Schools

French  
Good English  
Spanish

If you can read and write,  
and are willing to study,

**WE CAN TEACH YOU!**

• Special service and  
attention are always  
given to the student who  
may need extra help in  
order to understand.

REASONABLE TERMS  
MAY BE ARRANGED

The successful man DOES today what the failure  
INTENDS to do tomorrow. Mail this coupon NOW!

Special Tuition Rates for Members of the Armed Forces  
**INTERNATIONAL CORRESPONDENCE SCHOOLS**  
BOX 7669-K, SCRANTON 9, PENNA.

Please send complete information on following subject:

(Write above Technical, Business or General Educational Subject  
in which you are interested.)

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Employed by \_\_\_\_\_

Present Position \_\_\_\_\_





**J. E. SMITH, President,**  
National Radio Institute  
Established 39 Years  
He has directed the training of more  
men for the Radio Industry than any-  
one else.

**I WILL SEND  
A SAMPLE  
to PROVE I can Train You  
BE A RADIO**

## Vital Jobs Like These Go To Men I Train



**Communication Station Operator—**  
Am working in Civil Aeronautics Ad-  
ministration as Aircraft Communication  
Station Operator. Always C. O. of  
the station. Have a good salary and  
benefits. Have an interest in \$10  
per year. **J. E. SMITH, JR.,** Box 1025,  
Beverly Hills, Cal.



**\$400 a Month in Own Business—** For  
several years I have been in business  
for myself making a good \$400 a  
month. I have a good salary and  
benefits. I have a good salary and  
benefits. **A. J. PROFFER, JR.,** 100 W.  
Texas Ave., Oyster Creek, Texas.



**1st Lieutenant in Signal Corps—** I  
can tell you all the information on  
as to my type of work but I can  
say that N.R.I. training is really  
coming to the hands of the  
Signal Corps. **RICHARD W. AN-  
DERSON** (Address omitted for  
privacy reasons.)



**\$10 a Week in Spare Time—** I  
repaired some Radio when I was  
up to 10 years old. I made \$10  
a year and a half and I  
made an average of \$10 a week in  
my spare time. **JOHN JERRY,**  
1137 Kamehah, B., Denver,  
Colorado.



**Chief Operator Broadcasting Sta-  
tion—** Before I completed your  
lessons I obtained my Radio  
Broadcast Operator's License and im-  
mediately joined S. A. W. W. M. P. C.  
where I am now Chief Operator.  
**HOLLIS F. HAYES** 327 Madison St.,  
Lapeer, Michigan.

## MORE RADIO TECHNICIANS NOW MAKE \$50 A WEEK THAN EVER BEFORE!

I will send you a sample Lesson, "Getting Acquainted  
with Receiver Servicing," to show you how practical it is to  
train for Radio at home in spare time. It's a valuable lesson.  
Study it—keep it—use it—without obligation! Tells how

"Superhet" Circuits work, gives  
hints on Receiver Servicing,  
Locating Defects, etc. 31 illus-  
trations. And with this Lesson  
I'll send my 64-page illustrated  
book, "Win Rich Rewards in  
Radio." It describes many fas-  
cinating jobs Radio offers, ex-  
plains how N.R.I. trains you  
at home for good pay in Ra-  
dio. Get both FREE by mail-  
ing Coupon!



**RADIO SERVICING**  
(Illustration above)  
pays Technicians good  
money spare or full  
time. **RADIO OP-  
ERATORS** picture at  
right) And interesting  
work in U. S. Broad-  
casting and other  
types of Stations.



## Extra Pay in Army, Navy, Too

Men likely to go into military service,  
soldiers, sailors, marines, should mail  
the coupon now! Learning Radio helps



men get extra rank, prestige, more interesting duties, **MUCH  
HIGHER PAY.** Also prepares for good Radio jobs after  
service ends. Over 1,700 service men now enrolled.



GETTING ACQUAINTED  
WITH  
RECEIVER SERVICING

There's a big shortage today of capable Radio Technicians and Operators. Fixing Radios pays better now than ever before. With new Radios out of production, fixing old sets, which were formerly traded in, adds greatly to the normal number of servicing jobs. From Listening Stations, Aviation and Police Radio, and other Radio branches are scrambling for Operators and Technicians. Radio Manufacturers, now working up Government orders for Radio equipment employ trained men. The Government, too, needs hundreds of competent civilians and enlisted Radio men and women. You may never see a time again when it will be so easy to get started in this fascinating field.

Think of the NEW jobs that Television, Frequency Modulation, Electronics, and other Radio developments will, upon after the war! You have a real opportunity. I will train you to be ready to cash in when Victory releases the amazing wartime Radio developments for peacetime uses.

Right now, probably in your neighborhood, there's room for more space and full time Radio Technicians. Many NRI Students make \$5-\$10 a week EXTRA money fixing Radios in spare time while learning. I send EXTRA MONEY JOB SHEETS that tel. how to do it! My "Good Method" is building on a testing and Radio Circuits half learning that easy-to-grasp, illustrated lessons is a tested, proven way to learn Radio at home in spare time. Think how much practical experience you'll get by building the "Superhet" and Measuring Instrument illustrated at right by constructing 80 sets of experiments on these and other Circuits you build with parts I supply! Within a few months you can be ready to run your own Spare Time Shop fix the Radios of your friends and neighbors—get paid while learning!

**MAIL THE COUPON** I'll send you the FREE Lesson and my valuable, 64-page, Illustrated book. They're packed with facts about Radio. You'll see snapshots and letters from men I trained, so you can know what NRI did for others. You'll read a description of my Course—50-50 Method—4 Experimental Kits, Extra Money Job Sheets. You'll have my free Lesson to keep. And you'll see many fascinating job Radio offers and how YOU can train at home. No obligation, no expense what-so-ever. If you want to JUMP YOUR PAY—Mail Coupon in an envelope or pasted on penny postage! J. E. SMITH, President, Dept. 4BP3, National Radio Institute, Washington 25, D. C.

A black and white photograph of a vintage portable radio. The radio is a boxy, rectangular device with a carrying handle on top. It features a large speaker grille on the front and a control panel with several knobs and buttons. A carrying case is visible behind the radio. The text "Radio 6B" is partially visible in the upper right corner.

The ... ..  
... ..  
... ..  
... ..  
... ..  
... ..  
... ..  
... ..

[illegible][illegible]

Mr. J. E. Smith, President, Dept. 4BP3  
NATIONAL RADI0 INSTITUTE, Washington 25, D. C.

[illegible]

44 2111

Address \_\_\_\_\_

114 *Journal of Maritime Law and Commerce*

4PM

11



# Listening Post!

ALEX. E. GORDON, Indianapolis, Ind.—legislative representative of the Brotherhood of Locomotive Firemen and Enginemen—brings good news to hundreds of mothers of missing servicemen, through his hobby and his faithful 16-tube, 1940 model

## MIDWEST RADIO

**A**LWAYS a short-wave radio enthusiast, Alex. E. Gordon has spent many a night listening over his 16 tube Midwest Radio to foreign broadcasts. Several months ago he noticed that the Nazis, along with their propaganda, were mentioning the names of a few American prisoners each night. Mr. Gordon began to jot down the names and sent post-cards to the parents of the men named. The response to these cards was so instantaneous and gratifying that Mr. Gordon induced others to join with him in a Short Wave Listeners Club—each member of which is allotted a definite time at his listening post.

Mr. Gordon feels that he is amply repaid for his trouble by such grateful expressions of appreciation he has received: "It is a patriotic service for which I cannot thank you enough" . . . "God bless you for your kindness" . . . and other similar statements received by this Midwest Radio owner.

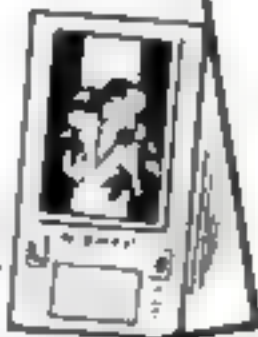
Just another case where a Midwest Radio, famous for its ability to pull in long distance stations even under the most adverse conditions, is doing yeoman duty, until Victory will permit us to turn from our production of radio and electronic devices for our Armed Forces and resume the manufacture of finer radio receivers—at lowest Factory - To - You prices and at savings up to 50%.



**BUY  
MORE  
WAR  
BONDS**

SEND FOR  
**FREE** INTERNATIONAL  
TIME CHART  
**CALENDAR**

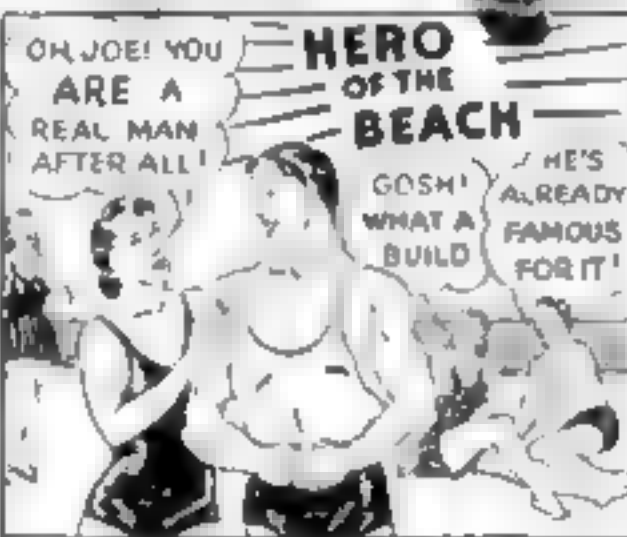
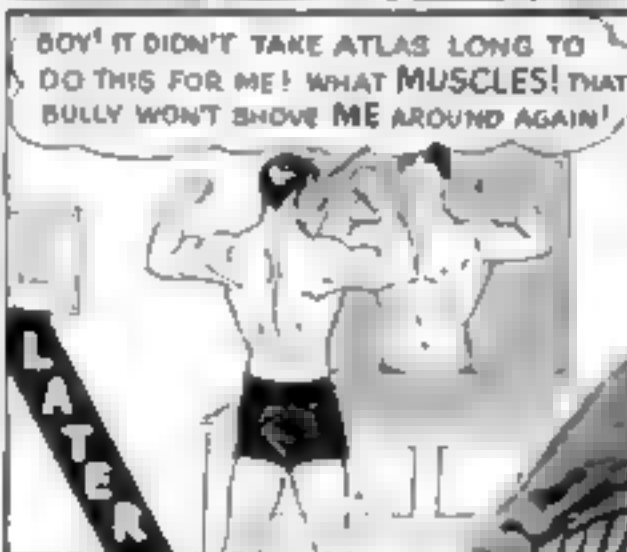
An attractive 4-color calendar with International Time Calculator will be sent **FREE** on your request if accompanied by 10c in stamps or coin for which we will send you a War Savings Stamp.



**MIDWEST RADIO CORPORATION**  
DEPT. 777 59-G ESTABLISHED 1929 CINCINNATI, OHIO



# HOW JOE'S BODY BROUGHT HIM FAME INSTEAD OF SHAME



## I Can Make YOU A New Man, Too in Only 15 Minutes A Day!

If YOU, like Joe, have a body that others can "push around"—if you're ashamed to strip for sports or a swim—then give me just 15 minutes a day! I'll PROVE you can have a body you'll be proud of, packed with red-blooded vitality! "Dynamic Tension." That's the secret! That's how I changed myself from a spindle-shanked, scrawny weakling to winner of the title, "World's Most Perfectly Developed Man."

### "Dynamic Tension" Does It!

Using "Dynamic Tension" only 15 minutes a day, in the privacy of your own room, you quickly begin to put on muscle, increase your chest measurements, broaden your back, fill out your arms and legs. Before you know it, this easy, NATURAL method will

make you a finer specimen of REAL MANHOOD than you ever dreamed you could be! You'll be a New Man!

### FREE BOOK

Thousands of fellows have used my marvelous system. Read what they say—see how they looked before and after—in my book, "Everlasting Health and Strength."

Send NOW for this book—FREE! It tells all about "Dynamic Tension," shows you actual photos of men I've turned from puny weaklings into Atlas Champions. It tells how I can do the same for YOU. Don't put it off! Address me personally Charles Atlas, Dept. 1B, 115 East 23rd St., New York 10, N.Y.



*Charles Atlas*

—actual photo of the man who holds the title, "The World's Most Perfectly Developed Man."

CHARLES ATLAS, Dept. 1B, 115 East 23rd St., New York 10, N.Y.

I want the proof that your system of "Dynamic Tension" will help make a New Man of me—give me a healthy, husky body and big muscular development. Send me your free book, "Everlasting Health and Strength".

Name \_\_\_\_\_ (Please print or write plainly)

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

☐ Check here if under 16 for Booklet A



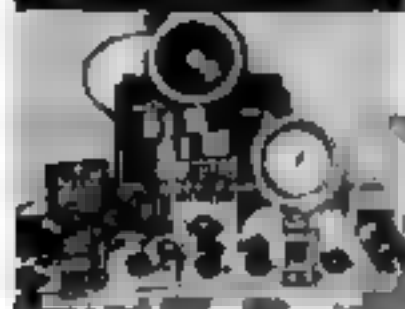
# HERE IS YOUR SUCCESS CHANCE BE A RADIO-ELECTRONIC TECHNICIAN



**SPRAYBERRY  
TRAINS YOU QUICKLY  
FOR WAR  
AND  
PEACETIME  
WORK**



**You Do Practice-Giving Experiments with  
FULL RADIO SET REAL EQUIPMENT**



course is short, intensive, and interesting. It starts right at the beginning of Radio. You can't get lost.

**YOU GET A DUAL-PURPOSE RADIO SET**

I supply you with Radio Parts which you use to gain pre-experience in Repair work. These same Parts are used for testing and for Signal Tracing, etc. You'll find my Course and Equipment fully described in the catalog offered below.



• Prepares You  
for a Business of Your Own... or  
Good Radio Jobs, Civilian or Military

I make it easy for you to learn Radio Set Repair and Installation Work... by practical, proved, time tested methods. I teach you how to install and repair Electronic Equipment, and give you the broad fundamental principles so necessary as a background no matter what branch of Radio you wish to specialize in. Soon you'll be qualified for a good paying job in one of the nation's Radio plants doing war work OR, if you enter the Army, Navy, or Marines, my training will help you win higher rating and better pay. Let me prove what Sprayberry training can do for you.

**JUST OFF  
THE PRESS!**

**"How to Test and Repair  
Radio Sets Without Meters"**

Developed in the Sprayberry Laboratory, this instructive volume tells about an amazingly simple, yet efficient method for Radio trouble-shooting and repair without use of regular equipment made scarce due to war. Send for this FREE book now while the supply lasts and along with it I will send you another big FREE book describing my Radio-Electronic training.

**MAIL COUPON**

**SPRAYBERRY ACADEMY OF RADIO**

F. L. Sprayberry, President  
Box 5002B, Pueblo, Colorado

Please rush my FREE copies of "HOW TO TEST AND REPAIR RADIO SETS WITHOUT METERS" and "HOW TO MAKE MONEY IN RADIO"

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

(Mail in plain envelope or paste on penny postcard)



# INVENTORS

## NOW Is the Time to PATENT and SELL Your Invention

Now, more than ever before, is the right time to patent your invention. Why? Because manufacturers everywhere presently engaged in war production are looking ahead to the future by buying up patent rights now, so they will have new and attractive items to make and sell for civilian consumption as soon as the war is over. This is what happened during and after the last war. Hence, the smart thing for you to do is to look ahead to the future too. Protect your invention by applying for a patent now, so you will be in position to cash in on an outright sale, or on the royalties your invention will bring.

### Patent Guide Shows What To Do

Our "Patent Guide for the Inventor" answers many important questions concerning Patents that inventors constantly ask. It tells what facts, details, drawings, sketches, etc., are necessary to apply for a Patent; how to protect your invention through dated and witnessed disclosure; how to do this AT ONCE to safeguard your rights; how Patent Office Records can be checked to determine whether the invention is probably patentable before filing fees need be paid; discusses costs involved and a practical way these can be paid as the application progresses. It tells how some inventors secured financial backing; how many simple inventions have proved large commercial successes; how Patents covering improvements also can be profitably utilized and marketed; tells countless other facts of interest.

### Why You Need Expert Assistance

The Patent Laws were enacted for your benefit—to give you protection for the features of your invention which are Patentable. But these features must be legally and concisely set forth in the form of "claims." This phase of the procedure is so complex that the Patent Office advises the Inventor to engage a competent Registered Patent Attorney. We maintain a large staff—carefully trained registered patent attorneys—expert draftsmen—experienced searchers—to serve you. We have been serving inventors for more than 20 years.

### Take First Step Now

With the Patent Guide you will receive also Free a "Record of Invention" form which will enable you at once to establish the date of your invention, before you file your Patent application. This step costs you nothing yet may be vital to your success. Remember—in Patent Matters, ACTION is IMPORTANT. Delay can be costly. Mail the coupon in an envelope, or paste it on a penny postcard NOW.

**CLARENCE A. O'BRIEN & HARVEY B. JACOBSON**

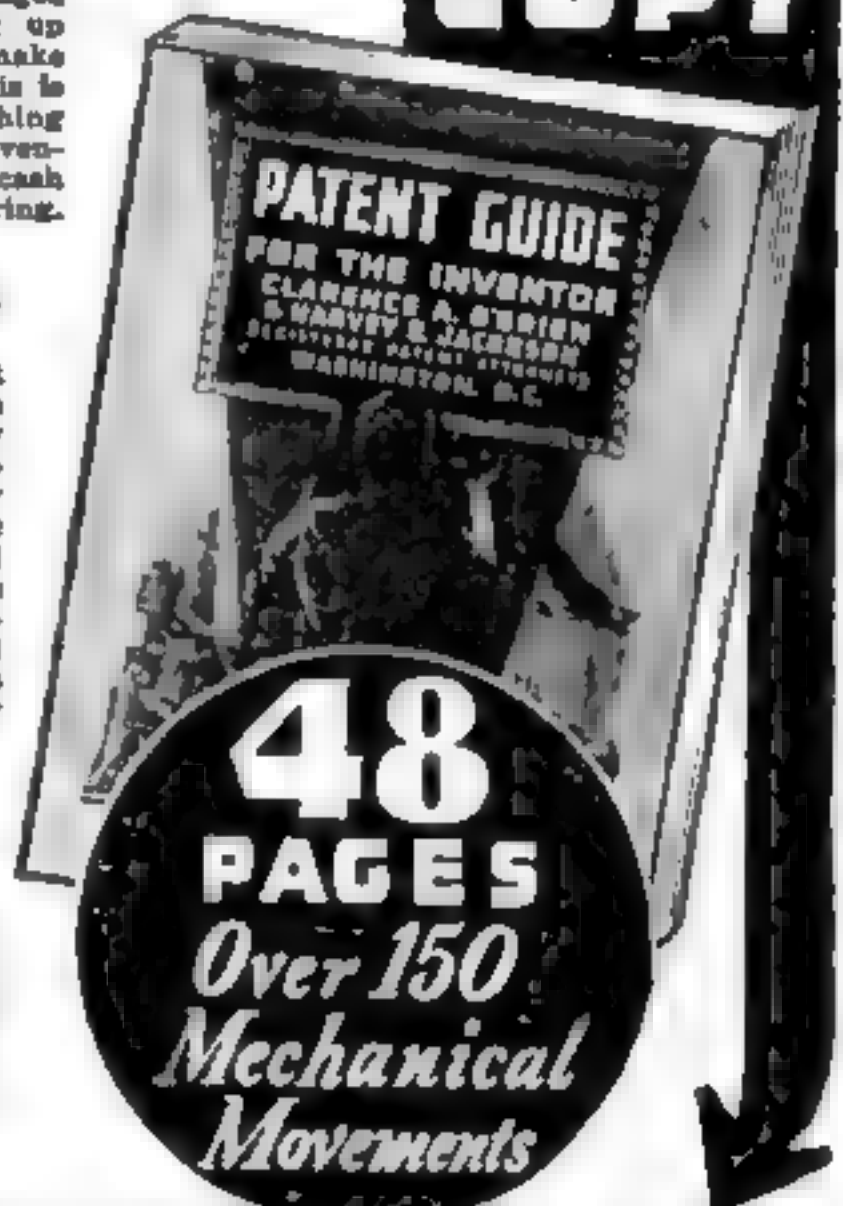
*"Worthy of your Trust"*

Registered Patent Attorneys  
42-B Adams Building  
Washington, D. C.

*Get This*  
**FREE BOOK**

**IMMEDIATELY MAIL COUPON TODAY!**

*Get*  
**FREE  
COPY**



**CLARENCE A. O'BRIEN  
& HARVEY B. JACOBSON**

**CLARENCE A. O'BRIEN & HARVEY B. JACOBSON**

Registered Patent Attorneys before the United States Patent Office

42-B Adams Building, Washington, D. C.

Please send me your 48-Page "Patent Guide for the Inventor" and your specially prepared "Record of Invention" form FREE. This request does not obligate me.

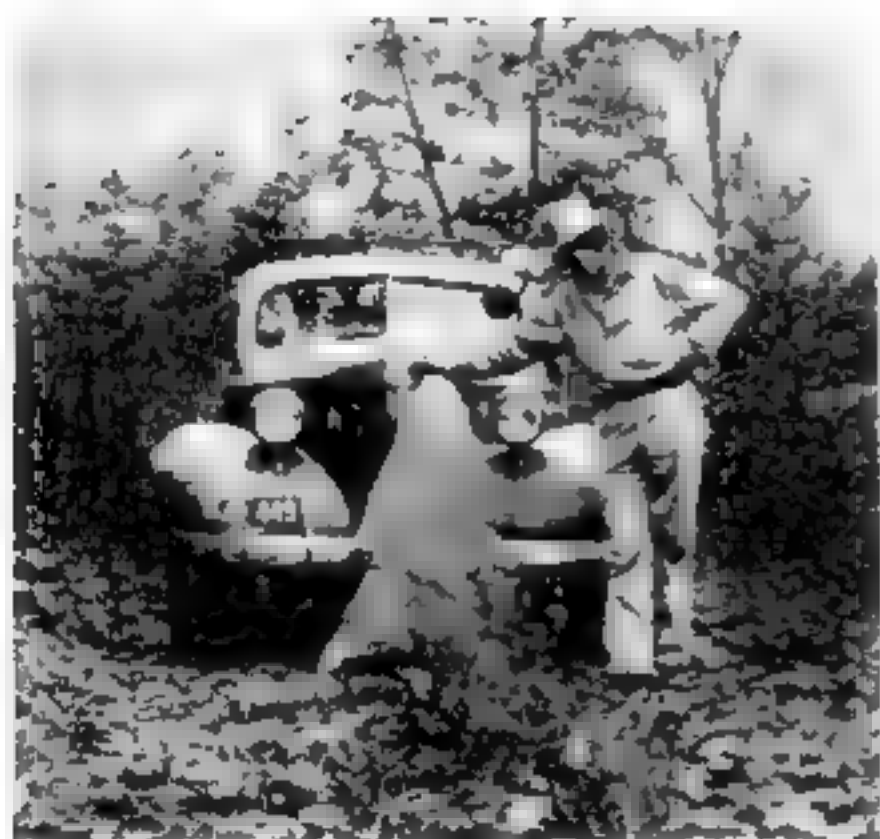
Name

Address

City  State

(Please write or print plainly.)





Discovered in the Ozarks, this giant arrowhead was carved by early American Indians in commemoration of a bloody war with De Soto. See letter below

## Biography of Pan American's Visible-Horizon Formula

I note that in your November issue W. H. comments on the formula used by Pan American pilots to compute the distance of the visible horizon—the formula being to take the square root of the product of 1.5 multiplied by the height of the eye in feet, which will give the distance of the visible horizon in miles. You may be interested to know how this formula was arrived at. The earth's curvature is approximately eight inches from mile to mile. Using the geometric law that the square of the unit distance multiplied by the drop per unit distance gives the total drop, we get this formula:  $D^2 \times \frac{8}{12} = H$  (where D equals unit distance;  $\frac{8}{12}$  represents the eight inches, or two thirds of a foot; and H is the height, or distance, of the total drop in feet). This formula, arranged to find the value of D, reads:  $D = \sqrt{\frac{3}{2} \times H}$ , or  $D = \sqrt{1.5 \times H}$ , which is the formula now in use by the pilots.—J. H. B., Topock, Ariz.

## Here's War Work Which Really Does Some Good

Your readers with home workshops can do one kind of war work which will mean a lot. By using their power tools, they can easily make up rough whittling kits—or other handicraft projects—to occupy convalescent soldiers and sailors in our hospitals. It doesn't take long to bandsaw a blank for a carved figure or plane-recognition model, and

## Readers Say:

the effort is small compared with what it might mean to some wounded youngster with time on his hands. Knocked-down boxes and simple footstools suitable for chip carving are other possibilities. To be certain his contribution will be what's wanted most, a hobbyist should get in touch with the medical officer in charge of rehabilitation at the nearest military or naval hospital.—H. V. C., San Francisco, Calif.

## Any Ideas on How to Blow Hot on Cold?

WINTER is here—and so is the freezing of water pipes. Do you suppose any of the "nuts" in Readers Say have an idea on how to make a small electric thawing device? I don't mean one of those large ones that thaw out four-inch, or even larger, pipes, but a small one hot enough to handle half-inch pipe that happens to be laid in places hard to get at with a blowtorch. I would also want one that could be plugged in on a regular house circuit.—C. E. H., Jerome, Ariz.

## Giant Arrowhead Found After 400 Years

I AM sending you a photograph of a giant arrowhead that I uncovered in the Ozark Mountains. It is 47 inches high, 30 inches wide at the base, 19 inches wide at the

neck, and has a maximum thickness of  $4\frac{1}{2}$  inches. It is definitely not a freak of nature. I was told about the stone by a full-blooded Indian over 15 years ago. I doubted its existence and thought it just a legend, but I recently found it just below the surface of the ground where it had been planted to

GREAT SECRET—



mark the entrance to a cave. Made of limestone, the arrowhead is a ceremonial stone that was carved to commemorate a bloody Indian war with Hernando De Soto and his band of 2000 warriors between the years 1538 and 1541.—E. N., Springdale, Ark.



# TO THE MAN WHO WANTS SUCCESS

## *after the WAR!*

If you want success and security when peace comes, prepare for it now. Make sure that you have the trained ability that employers will want and pay for in the post-war adjustment.

As business converts back to civilian goods, there will be urgent call for accountants, bookkeepers, salesmen, sales and credit correspondents, traffic managers, marketing men, secretaries, office managers and legally trained executives.

For 35 years, LaSalle has been training adults in their spare time for such positions.



It knows how. It can train you—quickly, thoroughly, at moderate cost, without interruption to your present work.

Mark the coupon below for our free booklet about the field of your interest. It costs nothing to get the facts and they may lead you to larger security and success—now and after the armistice whistles blow.

## LASALLE EXTENSION UNIVERSITY

### *A Correspondence Institution*

DEPT. 283-R

CHICAGO 15, ILL.

I am interested in knowing what your training is and how it can help me in the post-war adjustment. Please send me your free booklet on the field I have marked at right.

- ☐ Accounting
- ☐ Bookkeeping
- ☐ Salesmanship
- ☐ Business English

- ☐ Law: LL. B. Degree
- ☐ Business Law
- ☐ Office Management
- ☐ Business Correspondence
- ☐ Stenotypy: machine shorthand

- ☐ Traffic Management
- ☐ Executive Management
- ☐ Foremanship
- ☐ Industrial Management

Name ..... Age .....

Position ..... Address .....

City and State .....



# Readers Say:

## You Realize, of Course, Sir, That This Is War

IN YOUR November and December issues, you have omitted the usual complete table of contents. Since I have been keeping these



on file according to subject, I would appreciate it if you would include it in future issues. I am sure other readers would also like to have it.—L. C. S., Passaic, N. J.

Despite our limited supply of paper, caused by wartime rationing, our editorial, advertising,

and contents matter have been fighting tooth and nail for the same space that each was formerly allotted. So far we have been able to get only the table of contents to compromise.—Ed.

## A New Light on the Traffic Problem

I HAVE an idea for a stop light that would be connected with the regular rear stop light, but which would be placed on the front of the car. This front light, I believe, would promote safer driving, particularly at night when hand signals are next to useless. Suppose you are approaching an intersection on a boulevard protected by "stop" signs and see a car coming at you from the right. If you see its light go on, you know that the driver has his foot on the brake instead of the throttle, and is going to stop. Farther on, you see a car coming at you in the center line of traffic. If his light goes on, you know that he intends to make a left-hand turn. Is he going to give you the right of way? Or is he going to try to shoot in front of you? The answer to the latter is "no," for you see that his light is still on. If you are a pedestrian, you can always know the intentions of

an approaching car by looking to see if its front stop light is on or off. I feel certain that such a device would prevent many accidents and fatalities.—F. E. L., Los Angeles, Calif.

## No Argument. He's Got Us Dead to Rights

ON PAGE HW 576 of your November issue you refer to freeze-out plugs in an auto block. This idea seems to have spread through many sections of the country, but I hardly expected a mechanic to make such a mistake. The so-called freeze-out plugs have no more to do with freezing than the buttons on your shirt. These spots on the side of a block or head (usually in the form of a boss) are put there as a step in manufacture, and are solely to hold the sand core securely in the flask while the job is poured.—H. A., Carthage, Mo.

You've got us dead to rights, H. A. Various-ly referred to as wach plugs, core plugs, expansion plugs, and freeze plugs, they give a cylinder block scant protection against damage from freezing. Their principal purpose is to close off holes left to permit the core sand to be cleaned out.—Ed.

## He'll Start the Business —You Bring the Chickens

I HAVE just discovered a scheme for getting rich quick. The war brings about that opportunity. I propose to start a chain of "au-gratin" joints. Today I went into a local

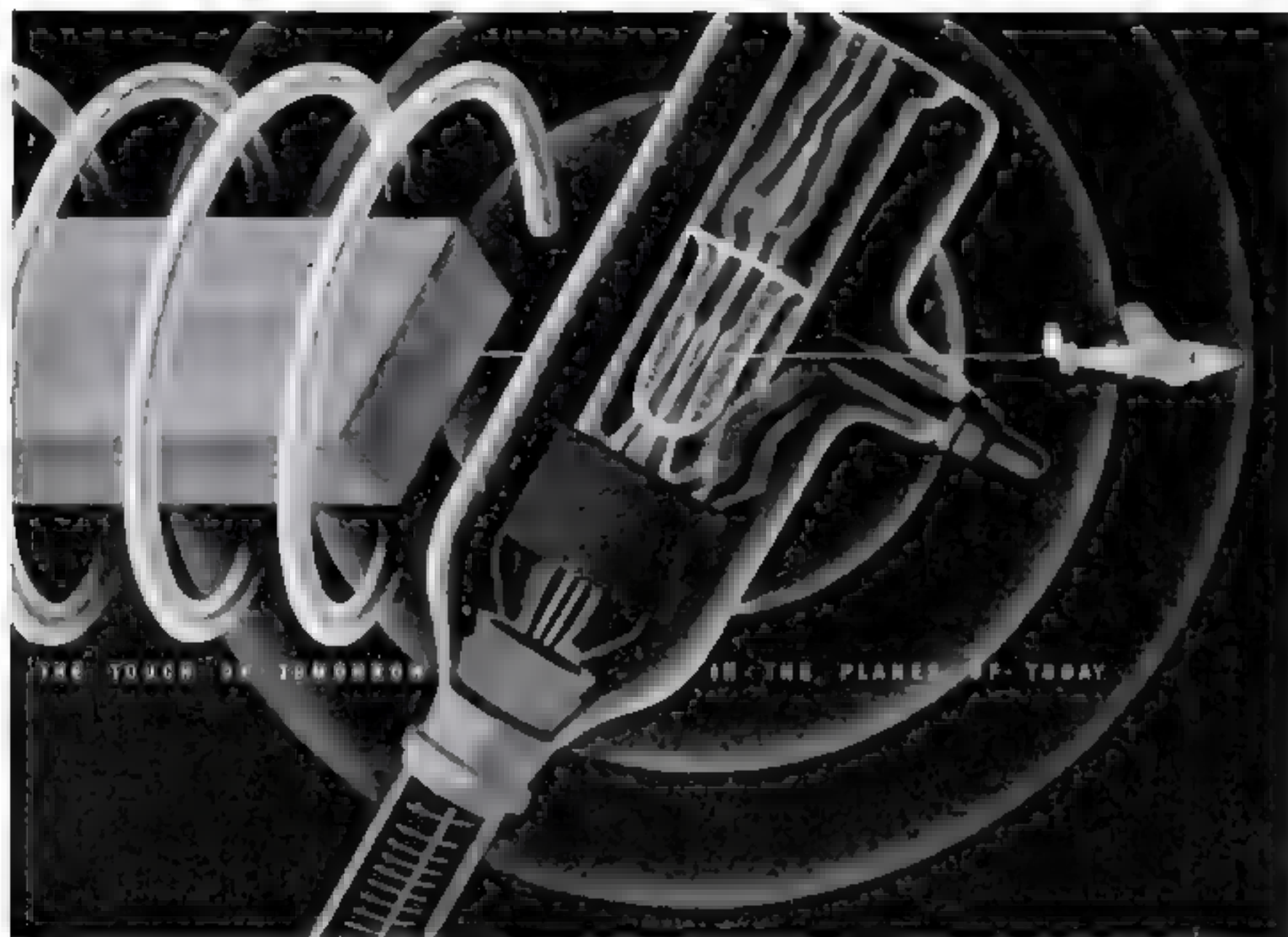
BETTER'N I EXPECTED—  
AT LEAST I CAN WISH FOR  
SOME CHICKEN



cafe. There was practically no meat listed on the menu, so I selected chicken with macaroni au gratin. And Oh Boy! was I chicken-hungry! When finally served, I began to explore the contents. I searched for some time in that dab of macaroni for some sign of chicken, and finally located two

small pieces which could best be seen with an electron microscope. I decided it was a game in which if you tasted chicken flavor you won. I lost. If any reader is interested in a partnership, I will be glad to supply a carload of macaroni au gratin for every chick that he can produce. I guarantee we'll be millionaires in a week.—A. B. C., Stockton, Calif.





## New Magic from the Mysterious Electron

Through X-ray, the unfathomable electron has saved millions of lives. Through radio, it has extended man's hearing to every corner of the world. Through television, it permits him to see beyond all previous limits of sight.

And now Fairchild's Duramold engineers have harnessed the electron to a new and urgent task—the manufacture of aircraft components.

The usual plywood techniques for joining thin layers of wood could not be applied in making highly stressed, thick sections. New methods were needed—in a hurry.

Duramold engineers found the solution in electronic energy, employing radio high frequency with

apparatus similar to that used by radio stations in sending out short wave broadcasts.

Heat generation by radio frequency, coupled with special adhesives, now turns out better, stronger aircraft parts. And the production cycle has been clipped from hours to minutes. The use of electronics is becoming a new and important technique in Duramold's process for assembling molded wood structures.

Thanks to the ingenuity of Fairchild engineers, with their flair for getting the "touch of tomorrow in the planes of today," a new technique has been successfully applied toward the common goal of turning out stronger planes—and doing it faster.

BUY U. S. WAR BONDS AND STAMPS

**FAIRCHILD**

ENGINE AND AIRPLANE CORPORATION  
30 ROCKEFELLER PLAZA, NEW YORK

Singer Aircraft Engines Division, Farmingdale, L.I. • Fairchild Aircraft Division, Hagerstown, Md. • Burlington, N. C. • Duramold Division, New York, N. Y.



# In Your Mind's Eye

## The Secret of MENTAL CREATING

IF you just like to dream, read no further. There comes a time when your fancies must be brought into light—and stand the test of every-day, hard realities. Are you one of the thousands—perhaps millions—whose thoughts never get beyond the stage of wistful wishing? Do you often come to from a daydream with the sigh, "If only I could bring it about—make it real?"

All things begin with thought—it is what follows that may take your life out of the class of those who hope and dream. Thought energy, like anything else, can be dissipated—or it can be made to produce actual effects. If you know how to place your thoughts you can stimulate the creative processes within your mind—through them you can assemble things and conditions of your world into a happy life of accomplishment. Mental creating does not depend upon a magical process. It consists of knowing how to marshal your thoughts into a power that draws, compels and organizes your experiences into a worth-while design of living.

## ACCEPT THIS *Free* BOOK

Let the Rosicrucians tell you how you may accomplish these things. The Rosicrucians (not a religious organization), a world-wide philosophical fraternity, have preserved for centuries the ancients' masterful knowledge of the functioning of the inner mind of man. They have taught men and women how to use this knowledge to recreate their lives. They offer you a free copy of the fascinating book, "The Mastery of Life." It tells how you may receive this information for study and use. Use coupon opposite.

*The* ROSICRUCIANS  
(AMORC)

SAN JOSE

CALIFORNIA

SCRIBE V. Z. A.  
The Rosicrucians (AMORC),  
San Jose, California.

Please send free copy of "The Mastery of Life,"  
and I shall read it as directed.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_





● Leaders in science and industry have long been saying, "Keep your eye on Plastics." But now the time for action has arrived. The future of huge possibilities has already begun. Developments in Plastics for hundreds of wartime uses have set the pace for revolutionary changes in peacetime production of thousands of products.

**Today there's a big need in vital war production for those who are trained in Plastics.** From one to a hundred articles made of Plastics must be supplied for every man in our fighting forces. Start training now in Plastics Engineering, in spare time in your own home. Fit yourself for a responsible, well-paid position. Help to win Victory. And at the same time you will be preparing for even greater opportunities when the war is over.

There is scarcely an industry in which these so-called "miracle materials" will not play an important part. After the war many old materials, methods and skills will be replaced. Acquire the all-important "know how." Be in a position to step into one of the key jobs.

**YOU CAN LEARN WHILE YOU EARN** Turn at least part of your leisure time into money. Qualify at home for a larger income in an interesting career. Build greater security for your future in a vocation that looms large on the horizon of the new industrial era. Hours you might otherwise waste can put you well on your way toward lasting success.

It's easy to find out about Plastics training. To get details and outline of study prepared by specialists, and about the school that has helped thousands to success during the past 46 years, write us or check and mail the coupon. Send today. The sooner you take this easy step, the sooner you will reach your goal and reap the rich rewards.

### AMERICAN SCHOOL OFFERS COMPLETE TRAINING SERVICE IN MANY SUBJECTS

You who have not completed high school or have missed vocational training in college, and who cannot spare time to go away to school, can complete your education in your choice of many subjects. Several of these are listed in the coupon at right. Check the subject in which you are interested, fill in your name and address, clip and mail the coupon today.

**AMERICAN SCHOOL**  
Dept. G-246 Drexel at 58th Street, Chicago 27

PRACTICAL, EFFECTIVE HOME - STUDY TRAINING SINCE 1897

### Take This First Easy Step

**CHECK, CLIP AND MAIL COUPON NOW**

- AMERICAN SCHOOL, Dept. G-246, Drexel at 58th, Chicago 27, Ill.  
Without obligation, Please send FREE and postpaid, bulletin and details of the Subjects checked.
- |  |   |  |
|--|---|--|
| <input type="checkbox"/> PLASTICS ENG'G            | <input type="checkbox"/> Accounting and C.P.A.              | <input type="checkbox"/> Drafting and Design for Men and Women |
| <input type="checkbox"/> Refrigeration             | <input type="checkbox"/> Cost Accounting for Manufacturing  | <input type="checkbox"/> Radio                                 |
| <input type="checkbox"/> Architecture and Building | <input type="checkbox"/> Bookkeeping                        | <input type="checkbox"/> High School                           |
| <input type="checkbox"/> Practical Plumbing        | <input type="checkbox"/> Private Secretary                  | <input type="checkbox"/> Air Conditioning                      |
| <input type="checkbox"/> Automotive Engineering    | <input type="checkbox"/> Diesel Engineering                 | <input type="checkbox"/> Shipbuilding                          |
| <input type="checkbox"/> Aviation Drafting         | <input type="checkbox"/> Surveying & Topographical Drafting | <input type="checkbox"/> Mechanical Eng.                       |
| <input type="checkbox"/> Aviation                  | <input type="checkbox"/> Sheet Metal Pattern Drafting       | <input type="checkbox"/> Shop Management                       |
| <input type="checkbox"/> Business Management       | <input type="checkbox"/> Electrical Engineering             | <input type="checkbox"/> Tool Making                           |
| <input type="checkbox"/> Railway Training          |   | <input type="checkbox"/> Better Foremanship                    |
|  |   | <input type="checkbox"/> Machine Shop Operations               |

Name . . . . . Occupation . . . . .  
Address . . . . . Apt. . . . .  
City . . . . . State . . . . .



# INVENTORS

This  
**BOOK**

and  
**INVENTION RECORD**  
(Cost You Nothing)  
**FREE BOOK**



## HOW TO PROTECT, FINANCE and SELL YOUR INVENTION

Our **FREE BOOK** and other literature available to our clients—gives you complete details on how to "ready" your invention for money-making. It tells you how others did it—who they went to for finances—how they arranged partnerships—how they made contacts with manufacturers—how they dictated royalty arrangements—how much money they made—how you can find a market. Our new **FREE BOOK** discloses sources of quick revenue if your invention is patentable and saleable with profit possibilities.

### THE FIRST STEP

The first step in getting your invention ready for market is to make a dated record of it on our "Invention Record" form. This form properly filled out and witnessed will be invaluable to you later in establishing the date of your invention should need for such evidence arise. We will be glad to send you our "Invention Record" and have it witnessed in this office when you return it with disclosure of your device. This service costs you nothing—and it immediately puts you on record as the originator of your device.

### Protect Your Invention NOW!

We have many letters in our files from manufacturers requesting inventions. Today's demand for new devices is tremendous—added to by emergency needs. Protect your invention now with a U.S. Patent. By acting promptly you may prevent another inventor getting in ahead of you at the Patent Office here in Washington. The first step is to make a sketch and description of your invention on our "Invention Record" have it witnessed and mail it to us. We will then make a Search of the U.S. Patent Office files to ascertain whether we can get patent protection for you. This is a step you should make NOW—before another steps in ahead of you and walks away with a patent.

COUPON  
THANK!

**McMORROW & BERMAN**  
PATENT ATTORNEYS

142-S Afton Building, Washington 5, D. C.

Send me your NEW **FREE BOOK** "How to Protect, Finance and Sell Your Invention," and specially prepared "Invention Record" form at once. I understand that this request does not obligate me.

NAME.....

ADDRESS.....

CITY.....STATE.....

Write or Print Name Clearly

## HOW I STEPPED *into* a Big Pay HOTEL JOB!

Without Hotel Experience, W. Bradley Hall Becomes Hotel Manager Increasing His Income 50%



"When I enrolled in the Lewis School, I was a Railroad Conductor. Shortly afterwards I went to work in a Chicago hotel. Within 60 days I was made Superintendent of Service. Within a year I was earning 50% more than in my previous position. Later I became Manager of an Iowa hotel, and recently took over the 'Y' cafe and am my own boss. I have made good, thanks to Lewis Spare-Time, Home-Study Training."

### HOTELS NEED TRAINED MEN AND WOMEN

Thousands of Lewis-trained men and women winning success in the colorful, essential hotel, club and institutional field. They are making good as Managers, Assistant Managers, Stewards, Hostesses, Executive

Housekeepers and 55 other types of well-paid positions. Today our Government's vast wartime housing, food and recreational program means greater opportunities than ever. Lewis graduates success has proved previous experience unnecessary in this business where you are not dropped because you're over 40. Good grade school education, plus Lewis Training qualifies you at home, in spare time. Write your name and address in the margin and mail the ad TODAY for Free Book which tells how you are registered free of extra cost in Lewis National Placement Service.



**Lewis Hotel Training School**  
Room CB-2785, (2nd) 12nd Washington 7, D. C.

## Learn **RADIO**

GET YOUR TRAINING  
IN COYNE SHOPS —  
WITH ACTUAL  
RADIO EQUIPMENT



Get ready NOW for your great Victory future in Radio Communications and Electronics. New streamlined training at COYNE covers latest developments in this field—prepares you for U.S. Government License test quickly, easily. Fascinating well-paid work in Aircraft Communication, Broadcast stations, Merchant Marine, Police Radio. "LEARN-BY-DOING" at Coyne!

### I'LL FINANCE YOUR TRAINING!

Start now—pay tuition after graduation. My plan has helped thousands. I assist you in getting part-time work while at COYNE to help pay living expenses. Real Job Service when trained. Facilities for men with physical handicaps. Ask for details!

### ELECTRONICS AND TELEVISION

Tremendous expansion in Communication Electronics and Television predicted after the war—a world of new opportunities. Get ready NOW with practical Coyne Radio Training.

**FREE BOOK!** Mail coupon, get facts now. Big Radio Future for trained men, whether you're 16 or up to 50. Send today!

H. C. LEWIS, Pres., RADIO DIV., COYNE ELEC. SCHOOL,  
500 S. Paulina St., Dept. 24-4H Chicago 12, Illinois

Send me **FREE BOOK**, "Your Future in Radio", and details of easy "Pay-After-Graduation" plan.

NAME.....

ADDRESS.....

CITY.....STATE.....



## AUDELS AIRCRAFT WORKER... \$1

Answers Your Questions on 1—Aircraft Materials, Terms, Parts 2—Blueprints, Work on Drawings 3—Mathematics, How to Figure 4—Layout & Bending 5—Tools & Machines 6—Riveting, Spot Welding & Hints 7—Fabrication, Angles, etc. 8—Assembly, Fuse age, Wing & Final—How to Use Tools 9—Tables & Data, Symbols, Army & Navy Specifications, etc. 216 Pages illus.

## AUDELS SHEETMETAL PATTERN LAYOUTS... \$4

Developed by Experts for Sheet Metal Workers Layout Men & Mechanics. A Practical Encyclopedia in 10 Sections, size 1 x 10 x 2—1125 Pages—350 Layouts—1600 Illustrations 1001 Key Facts. Fully indexed for ready reference in answering your layout problems. Covers all phases of sheet metal work including Pattern Cutting, Pattern Development & Shop Procedure.

## AUDELS SHEETMETAL WORKERS HANDY BOOK... \$1

Practical inside information. Fundamentals of Sheet Metal Work. 388 pages. Illustrated. 11 sections. Clearly written. Extensive & important facts, figures, pointers in everyday language. Ref. Index.

## AUDELS WELDERS GUIDE... \$1

A concise practical text on operation & maintenance of all welding machines for all mechanics. Over 400 pages illustrated. Covers all methods of electric and acetylene welding including airplane work.

## AUDELS ANSWERS ON BLUE PRINT READING... \$2

For Mechanics & Builders. Covers all types of blue print reading including ship & airplane. 376 pages, fully illustrated.

## AUDELS NEW MACHINIST & TOOLMAKERS HANDY BOOK... \$4

Covers modern machine shop practice in all its branches. 5 practical books in 1. New from cover to cover. Tells how to set up & operate lathes, screw and milling machines, shapers, drill presses and all other machine tools. 1400 pages, fully illustrated, 5 x 8 1/2 x 2 Indexed. 5 sections: 1—Modern Machine Shop Practice 2—Blue Print Reading & How to Draw 3—Calculations & Mathematics for Machinists 4—Shop Physics 5—How to Use the Rule Rule. 60 chapters. Easy to read and understand. A shop companion that answers your questions.

## AUDELS MATHEMATICS & CALCULATIONS FOR MECHANICS \$2

Mathematics for home study or reference. 700 pages, 350 illus. Practical mathematics from beginning. How to figure corner by. Easy, correct methods covering a complete review. Ill & Indexed.

## AUDELS AUTOMOBILE GUIDE... \$4

A practical, quick ready reference book for auto mechanics service men, operators & owners. Explains theory, construction & setting of modern motor cars, trucks, buses & auto type Diesel engines. 1640 pages, fully illustrated. 55 chapters. Indexed. A standard book for mechanics. New fluid drive covered.

## AUDELS DIESEL ENGINE MANUAL \$2

A practical, concise treatise with questions and answers on the theory, operation and maintenance of modern diesel engines including General Motors 2 cycle Diesel. 244 pages, fully illus. Flexible binding pocket size. All details plainly brought out, this book is of extreme value to engineers, operators & students.

## AUDELS RADIOMANS GUIDE... \$4

A key to the practical understanding of radio including Frequency Modulation, Transmission, Air, Aircraft & Marine Radio. For radio engineers, servicemen, amateurs. 772 pages. 400 illustrations & Diagrams. Photos, Review Questions & Answers, Reference Index. Authoritative, clear, concise.

## AUDELS HANDY BOOK OF PRACTICAL ELECTRICITY... \$4

For maintenance engineers, electricians & all electrical workers. 1410 Pages. 2600 illus. Covers important electrical information in handy form—including Marine Wiring, Radio Principles, Welding. Indexed. A key to a practical understanding of electricity.

## AUDELS CARPENTERS & BUILDERS GUIDES—4 Vols... \$6

A practical illustrated trade assistant on modern construction for carpenters, joiners, builders, mechanics and all woodworkers. 4 vols., 1600 pages, 3700 illustrations, flexible covers. Each volume pocket size. Sold separately \$1.50 a vol.

## AUDELS PLUMBERS & STEAMFITTERS GUIDES—4 Vols... \$6

A Practical Trade Assistant & Ready Reference. Explains in plain language & by clear illustrations, diagrams, charts, graphs, principles of modern plumbing practice including Marine Pipe Fitting and Air Conditioning. 4 Vols.—1670 Pages—3641 Diagrams. Each Vol. Pocket Size. Sold Separately \$1.50 a Vol.

## AUDELS WIRING DIAGRAMS... \$1

210 Pages. Illustrated. Gives practical facts on wiring of electrical apparatus. It explains clearly in simple language how to wire apparatus for practically all fields of electricity. Each diagram is complete & self-explanatory. Highly Endorsed Pocket Companion.

## AUDELS ELECTRONIC DEVICES... \$2

Tells What You Want to Know About Electric Eye. Easily Understood. Covers photo-electric cells & their applications. Amplifiers, Illumination, frequencies, voltage, photogal, tubes, Ohm's Law, wiring diagrams, etc.

**AUDELS, Publishers, 49 W. 23 St., N. Y. 10**



## AN AUDEL GUIDE IS A GOOD FRIEND!

Use the brains and experience of others in these Guides of the Trades. Save time and money with right methods, short cuts, labor saving ideas. CHECK NOW! You can look over any Audel Guide in your home. Start the Easy Payments if satisfied.

## ----- CUT HERE ----- MAIL ORDER

THEO. AUDEL & CO., 49 W. 23rd St., New York 10

Please mail me for 7 days' free examination the books marked (X) below. I agree to mail \$1 in 7 days on each book or set ordered, and to further mail \$1 a month on each book or set ordered until I have paid purchase price.

If I am not satisfied with Guides I will return them.

- |   |     |
|---|-----|
| <input checked="" type="checkbox"/> Audels PUMPS, HYDRAULICS & AIR COMPRESSORS \$4.   |     |
| <input checked="" type="checkbox"/> Audels WELDERS GUIDE                              | 1.  |
| <input checked="" type="checkbox"/> Audels BLUE PRINT READING                         | 2.  |
| <input checked="" type="checkbox"/> Audels SHEET METAL WORKERS Handy Book             | 1.  |
| <input checked="" type="checkbox"/> Audels SHEET METAL PATTERN LAYOUTS                | 4.  |
| <input checked="" type="checkbox"/> Audels AIRCRAFT WORKER                            | 1.  |
| <input checked="" type="checkbox"/> Audels MATHEMATICS and CALCULATIONS               | 2.  |
| <input checked="" type="checkbox"/> Audels MACHINISTS & TOOLMAKERS Handy Book         | 4.  |
| <input checked="" type="checkbox"/> Audels DIESEL ENGINE MANUAL                       | 2.  |
| <input checked="" type="checkbox"/> Audels MECHANICAL Dictionary                      | 4.  |
| <input checked="" type="checkbox"/> Audels AUTO GUIDE                                 | 4.  |
| <input checked="" type="checkbox"/> Audels MACHINE ENGINEERS HANDY BOOK               | 4.  |
| <input checked="" type="checkbox"/> Audels SHIPFITTERS Handy Book                     | 1.  |
| <input checked="" type="checkbox"/> Audels MARINE Engineers Guide                     | 3.  |
| <input checked="" type="checkbox"/> Guths MECHANICAL DRAWING COURSE                   | 1.  |
| <input checked="" type="checkbox"/> Rogers MECHANICAL DRAWING and Design              | 2.  |
| <input checked="" type="checkbox"/> Audels MILLWRIGHTS and Mechanics Guide            | 4.  |
| <input checked="" type="checkbox"/> Audels CARPENTERS and Builders Guides (4 vols.)   | 8.  |
| <input checked="" type="checkbox"/> Audels PLUMBERS and Steamfitters Guides (4 vols.) | 8.  |
| <input checked="" type="checkbox"/> Audels MASONS and Builders Guides (4 vols.)       | 8.  |
| <input checked="" type="checkbox"/> Master PAINTER and DECORATOR                      | 2.  |
| <input checked="" type="checkbox"/> Audels GARDENERS & GROWERS GUIDES (4 vols.)       | 8.  |
| <input checked="" type="checkbox"/> Audels ENGINEERS and Mechanics Guides             |     |
| Nos. 1, 2, 3, 4, 5, 6, 7 and 8 complete   | 12. |
| <input checked="" type="checkbox"/> Audels Answers on Practical ENGINEERING           | 1.  |
| <input checked="" type="checkbox"/> Audels Answers on REFRIGERATION                   | 2.  |
| <input checked="" type="checkbox"/> Hawkins Aids to ENGINEERS EXAMINATION             | 2.  |
| <input checked="" type="checkbox"/> Rogers MACHINIST GUIDE                            | 2.  |
| <input checked="" type="checkbox"/> Audels WIRING DIAGRAMS                            | 1.  |
| <input checked="" type="checkbox"/> Audels Handy Book of PRACTICAL ELECTRICITY        | 4.  |
| <input checked="" type="checkbox"/> Audels ELECTRICAL POWER CALCULATIONS              | 2.  |
| <input checked="" type="checkbox"/> Hawkins ELECTRICAL Guides at \$1. each            | 12. |
| <input checked="" type="checkbox"/> Audels ELECTRONIC DEVICES                         | 2.  |
| <input checked="" type="checkbox"/> Audels ELECTRIC Dictionary                        | 2.  |
| <input checked="" type="checkbox"/> Audels RADIOMANS GUIDE                            | 4.  |
| <input checked="" type="checkbox"/> Audels NEW ELECTRIC LIBRARY at \$1.50 a Volume    |     |
| Vols. I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII.                               |     |

Name.....

Address.....

Occupation.....

Employed by..... P.B.M.



# ENLARGED, REVISED EDITION of AIRCRAFT DATA BOOK

Just off the Press

GIVES YOU

*Experts  
at your fingertips!*



Here is the book aircraftmen, mechanics and shop men have been waiting for—has more than two hundred pages of data on airplane building, servicing and shop practices; prepared by experts who know the practical ways to speed work in every department.

## PRACTICAL - HELPFUL - NEW

You will find answers to hundreds of questions about materials, methods, special tools and similar subjects. Drawings show how to fabricate Plexiglas, adjust welding torches, identify rivets and sheet materials, install cable terminals, read blue-prints, AND IN A THOUSAND OTHER WAYS how to save time and increase your usefulness in any factory or repair base.

The Aircraft Data Book is now used by thousands of men and women, and by prominent aircraft factories, as their new "tool" against the enemy. Order your copy today—use the coupon below—your copy will be sent postpaid at once.

Aero Tech is particularly fitted to produce such a reference book—for Aero Tech's sole business for years has been the training of aircraft mechanics and aeronautical engineers for industry or the Army Air Forces.

## TABLES AND CHARTS

Hundreds of special drawings never before available in any data book have been especially prepared for this one.

## DRAWINGS AND SKETCHES

The Aircraft Data Book is profusely illustrated so any person can clearly understand modern airplane construction.

## AERO INDUSTRIES TECHNICAL INSTITUTE

5247 W. San Fernando Road  
Los Angeles 26, California



Ralph Hemphill,  
President

### AERO INDUSTRIES TECHNICAL INSTITUTE

5247 W. San Fernando Road, Los Angeles 26, Calif.

Gentlemen: Enclosed find \$1.50 (check, money-order) for my copy of AIRCRAFT DATA BOOK

Name \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_ A-9-S

## SECTIONAL INDEX OF AIRCRAFT DATA BOOK

Alt Standards Part, Alphabetical and Numerical Lists, Section 1

Clear and concise methods of decoding Alt Standards, Pages covering Bolts, Pins, Screws, Nuts and Rivets embracing Sections 2, 3, 4 and 5

Locking Devices and Safetying, Section 3

Turnbuckle Assemblies and Methods of Safetying, Section 4

Drafting Practices and Mathematics, Section 7

Sheet Metal Lay-out, Bend Allowance, Developed Length, Tables and Charts, Section 7-A

Aircraft Tubing and Fittings, Section 9

Welding and Flame Adjustments, Section 10

Stools, Section 11

Fabric Covering and Dopeing, Section 12

Plexiglas Forming, Finishing and Repairing, Section 12-A

Applicable Useful Tables, Section 13

Micrometer Reading, Simplified, Section 13-A

Production Operations Defined and Safety Rules, Section 14

General Abbreviations, Section 15

Aircraft Nomenclature, Section 16, Embracing 48 pages

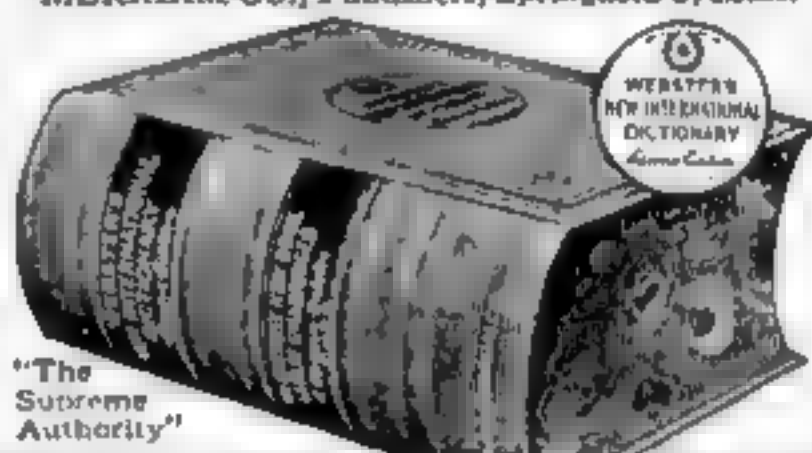
# If You Have Had to Wait for Your Copy of WEBSTER'S NEW INTERNATIONAL DICTIONARY, Second Edition

*This Is the Reason:*

THE rationing of paper has made unavoidable a restriction in production and heavy government needs must be supplied—all in the face of the greatest civilian demand for the Merriam-Webster in our history. Naturally there are not enough copies to make possible prompt delivery to everyone. Please wait as patiently as you can for your bookseller to supply you.

## GET THE BEST—Even If You Have To Wait For It

The Merriam-Webster is the standard of schools and colleges, State Supreme Courts, the Government Printing Office; professional and business offices everywhere. Contains 600,000 Entries—122,000 more than in any other dictionary. 12,000 terms illustrated. 3,350 Pages. G. & C. MERRIAM CO., Publishers, Springfield 2, Mass.



"The  
Supreme  
Authority"

# DRAFTSMEN NEEDED Now



Industry is clamoring for more draftsmen for the job can't start until plans are drawn. Buildings, airplanes, machines, guns, tanks, bridges, all start on the drafting board, so it's no wonder that every good draftsman has a fine job. Yes, more draftsmen are needed NOW. The pay is good and the opportunities for advancement great.

## Learn at Home in Spare Time

Begin now to turn spare hours into money. Be a draftsman, the connecting link between a mechanic and an engineer. Enjoy the wonderful opportunities for promotion that exist now. No experience or artistic talent is needed. You don't have to leave your present job while learning. Use spare time.

American School, Dept. 00248, Bryant Ave. at 58th Street, Chicago 37, Ill.

Gentlemen: Send me FREE information covering special training in subjects checked below. No obligation on my part.

- |  |   |
|--|---|
| <input type="checkbox"/> Drafting and Design for men and women | <input type="checkbox"/> Electrical Engineering |
| <input type="checkbox"/> Cost Accounting for Mfg.              | <input type="checkbox"/> Diesel Engineering     |
| <input type="checkbox"/> Architecture and Building             | <input type="checkbox"/> High School Course     |
| <input type="checkbox"/> Automotive Engineering                | <input type="checkbox"/> Plastics               |
| <input type="checkbox"/> Business Management                   | <input type="checkbox"/> Mechanical Engineering |
| <input type="checkbox"/> Railway Training                      | <input type="checkbox"/> Aviation               |
|  | <input type="checkbox"/> Shipbuilding           |
|  | <input type="checkbox"/> Radio                  |

Name \_\_\_\_\_

Address \_\_\_\_\_



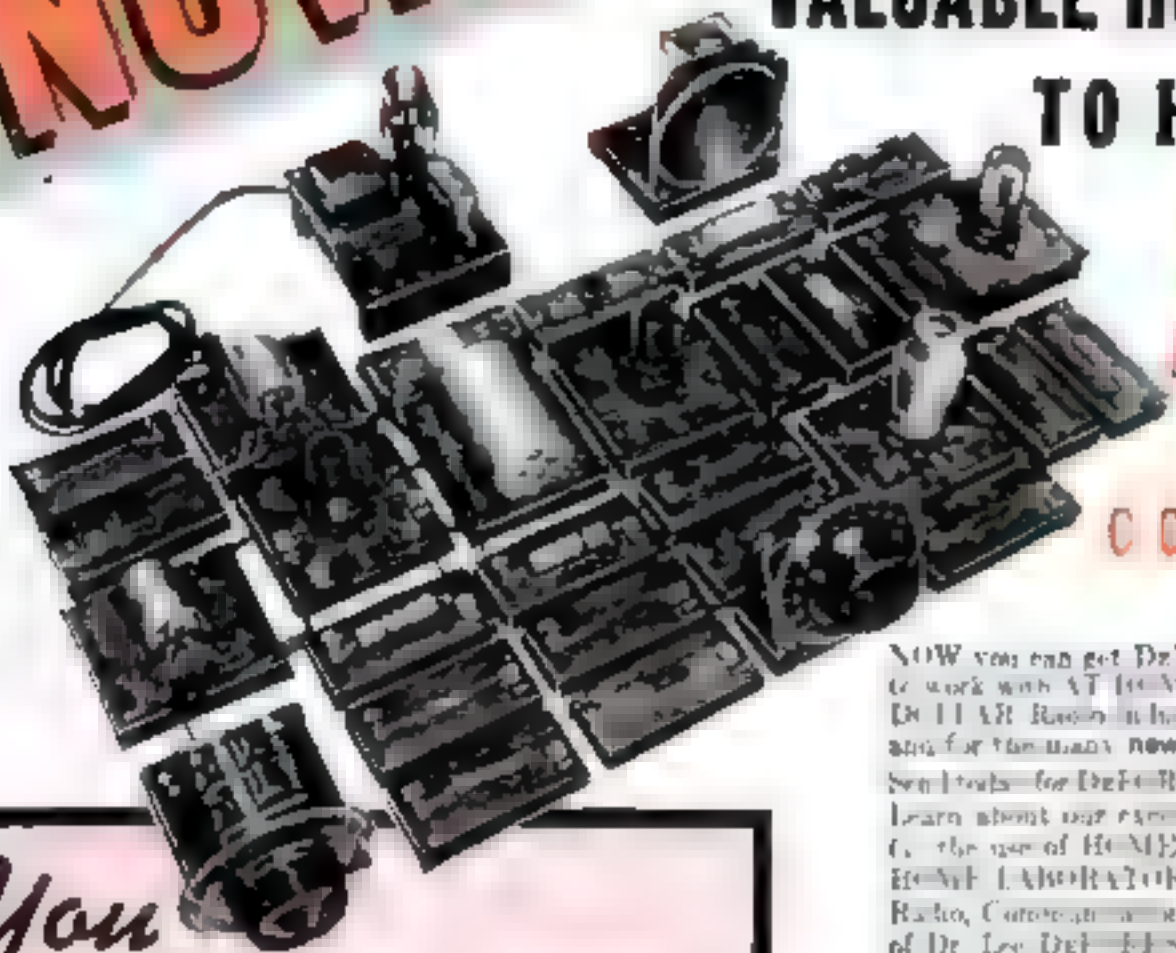
# NOW!

# WHILE THEY LAST!

## VALUABLE HOME TRAINING KITS TO HELP YOU LEARN

# RADIO

## ELECTRONICS COMMUNICATIONS



### You GET THIS AND OTHER EQUIPMENT

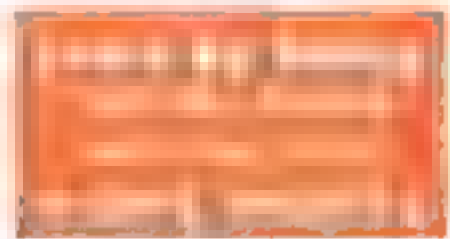
DeFOREST'S TRAINING loans you a wide variety of Radio parts and equipment for use at home. You work out scores of the simplest, brand Electric experiments quickly and easily by means of DeFOREST'S unique "check system." You experiment with Light Beam Transmission, you build an Aviation Band Radio Receiver, Wireless Microphone, Cathode Ray Oscilloscope, Electric Fan, and many other projects. This gives you valuable, practical experience to you. That's DeFOREST'S exclusive 3-WAY TRAINING METHOD.

**IMPORTANT!** The supply of these DeFOREST'S "check system" Home-Training Kits is limited. They will go to those who order first. You know Radio parts are hard to obtain. But once you have them, you can work out the theories you've been studying and see why and how radio works. Don't delay! Mail the coupon TODAY.

NOW you can get DeFOREST'S practical SHOP-METHOD training aid — to work with AT HOME. Prepare for good jobs in America's BILLION DOLLAR Radio industry — for opportunities in the Army and Navy — and for the many new after-the-war Electronic developments.

Send today for DeFOREST'S big FREE book — "VICTORY FOR YOU!" Learn about our exclusive 3-Way Training Method. How you get (1) the use of HOME TRAINING FILMS and a movie projector, (2) HOME LABORATORY EQUIPMENT and (3) 364 lessons and lessons in Radio, Cathode Rays and Electronics prepared under the supervision of Dr. Lee DeFOREST, often called "the father of Radio." Learn the meaning of the Visual Home-Training was first suggested by DeFOREST'S TRAINING'S founder, the late Dr. Herman A. DeVry, inventor of the portable motion picture projector and founder of the DeVRY CORPORATION, manufacturers of motion picture material and electronic equipment.

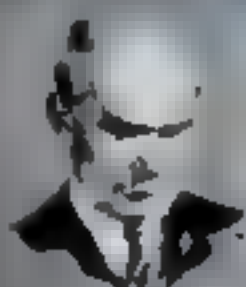
DeFOREST'S effective Employment Service offers you a practical way to make your start in Radio and Electronics, once you are trained. If you are 17 or over, mail the coupon below.



Project dramatic, easy-to-learn films, and motion pictures right in your own room. Learn radio with the aid of DeFOREST'S exclusive Home-Movie-Training method. Learning is fun, more effective. Many more new and interesting things to learn. Don't wait! Get your kit of training NOW! TODAY! from DeFOREST'S.

## DeFOREST'S TRAINING, INC.

### LET THEIR EXPERIENCE GUIDE YOU



Dr. Lee DeForest  
— supervised the  
Preparation of  
DeForest's Training.



Dr. Herman A. DeVry—Visual  
Education Pioneer  
— founded De-  
Forest's Training.



**DeFOREST'S TRAINING, INC.**  
2535-41 N. Ashland Ave. Dept. M Chicago, U.S.A.

Please send me — FREE and WITHOUT OBLIGATION — your illustrated book "VICTORY FOR YOU" showing me how I can get your Home-Movie Training and Home Laboratory Kits.

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_ State \_\_\_\_\_

City \_\_\_\_\_

*Mail This Coupon*





# Follow this Man

*Secret Service Operator 38 is on the job*

**F**OLLOW him through all the excitement of his chase of the counterfeit gang. See how a crafty operator works. Telltale finger prints on the lamp stand in the murdered girl's room! The detective's cigarette case is handled by the unsuspecting gangster, and a great mystery is solved. Better than fiction. It's true, every word of it. No obligation. Just send the coupon and get—

## FREE!

**The Confidential Reports  
No. 38 Made to His Chief**

And the best part of it all is this—it may open your eyes to the great opportunity for YOU as a well paid Finger Print Expert. This is a young, fast-growing profession. This school has taken men and trained them for high official positions. This is the kind of work you would like. Days full of excitement. A regular monthly salary. Rewards.

## Can you meet this test?

Are you ambitious? Would you give 30 minutes a day of your spare time preparing yourself for this profession? Answer "yes" and I'll show you how it is possible for you to attain all this. Send the coupon and I'll send you Free Reports.

**INSTITUTE OF APPLIED SCIENCE**  
1920 Sunnyside Ave., Dept. 1362, Chicago 40, Illinois

### Institute of Applied Science

1920 Sunnyside Ave., Dept. 1362, Chicago 40, Illinois

Gentlemen:—Without any obligation whatever, send me the Reports of Operator No. 38, also your illustrated Free Book on Finger Prints and your low prices and Easy Terms Offer. Literature will be sent only to those stating age.

Name .....

Address .....

Age .....

# AVIATION

## FOR YOUR CAREER PLUS WAR SERVICE



*Both*

### AT THE SAME TIME

Before you are 18 MAKE YOURSELF THE KIND OF MAN THE AVIATION INDUSTRY OR THE AIR SERVICES WANT... THE KIND THEY CANNOT DO WITHOUT... so you can ADVANCE RAPIDLY. Since 1929, Curtiss Wright Tech has been specializing in modern and progressive training for Aeronautical Engineers and Master Aviation Mechanics. No lying involved! Write for full information. Include name, address and date of birth. Dept. PS-2

**CURTISS  
TECHNICAL**



**WRIGHT  
INSTITUTE**

GRAND CENTRAL AIR TERMINAL  
Glendale (Los Angeles Co.) California

THE WORLD OVERLOOKS AVIATION'S MOST OUTSTANDING SCHOOL OF AERONAUTICS

## HOME TRAINING FOR Machinists

Beginners and old-timers rave over  
this easy war-time speed-up

### MACHINE SHOP TRAINING COURSE

Total Price \$12.50—Easy Terms

Now for the first time the world of machinery is concentrated into a complete 3-volume course. Vitally necessary for all Machinists. Quick Training Course for beginners who seek good pay jobs in Machine Shop Work.

**HUNDREDS OF DRAWINGS  
AND TIME SAVING CHARTS**

This training at home is comparable to the practical fundamentals learned by resident students at famous National Schools. Easy to follow and understand. Machine tools completely described and demonstrated. Measurements and Gauges. Drill Press operations. Milling Machines. Shapers. Planers. Grinders. Blueprint Reading and Drafting. Hundreds of other subjects essential in your daily work leading to better pay.

National Schools, Dept. C-2  
4000 S. Figueroa Street  
Los Angeles 27, California

Ship me for examination Modern Machine Shop Training Course, 3 vols., plus gifts. Within 7 days I will either return shipment or mail you \$3.00 and \$3.00 a month until \$12.50 is paid (final payment \$3.50). Save 10% Deduct \$1.25 if you enclose cash (\$12.25) with this coupon. Same return privilege.

Name .....

Address .....

City and State .....

**SEND NO  
MONEY!**

**FREE 7-DAY  
TRIAL EXAMINATION**

**BONUS**

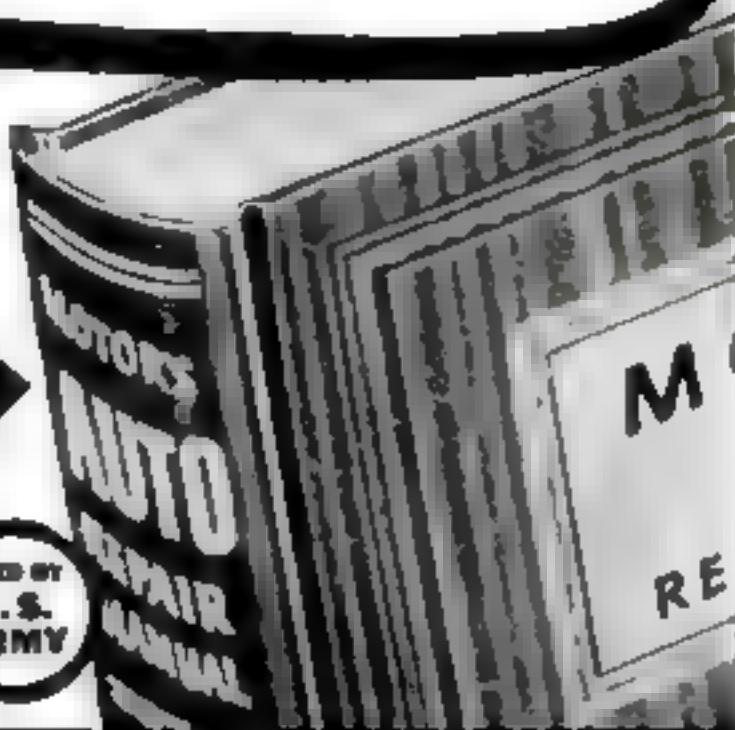
For Promptness  
7 Drafting Lessons,  
Machinist's Dic-  
tionary, Shop  
Mathematics Text,  
MAIL THE COUPON NOW!



# Now YOU Can Lick Any AUTO REPAIR JOB!

IN LESS TIME—WITH LESS WORK

**FREE  
7-DAY OFFER**



USED BY  
U. S.  
ARMY

**MoTor's New Auto REPAIR MANUAL**  
shows you how to service and  
repair ANY part of ANY car!

No auto repair job is too tough when you've got MoTor's AUTO REPAIR MANUAL! YOU can repair anything from carburetor to rear end—quickly, easily, right! Just look up make, model, and the job in the quick index—and go to work! Clear, illustrated instructions lead you step by step.

To make such an amazing book possible, the engineer-editors of MoTor Magazine collected and "broke down" 150 official factory shop manuals for you, spotted all the vital repair information you need, dove-tailed it all together into ONE handy, easy-to-understand book.

## No Other Manual Like It!

This BIG book—840 pages, 8 1/4 x 11 inches, bound in sturdy cover—brings you nearly 200,000 service, repair, adjustment, replacement, tune-up facts on every car built from 1935 to 1942. More than 1000 cut-away photos, diagrams,

drawings show you exactly WHAT to do and HOW to do it! Used by the U. S. Army, trade and technical schools everywhere, thousands of auto servicemen.

Now YOU—without cost—can see for yourself what a wonderbook MoTor's Auto Repair Manual really is. TRY IT—FREE for 7 days! Learn first-hand how it can pay for itself the first few times you use it.

## SEND NO MONEY 7-Day Free Examination

Just mail coupon below—without money! When the postman brings your book, pay him nothing. First make it show you what it's got! Unless you agree this is the greatest time-saver and work-saver you've ever seen—return book in 7 days and pay nothing. Mail coupon today! Address: MoTor Book Department, Desk 2B, 572 Madison Ave., New York 22, New York.

## Clear, Pictured Facts on Every Job on Every Car Built Since 1935!

Nearly 200,000 service and repair facts on all these makes:

American	Ford	Oldsmobile
Bentley	Graham	Overland
Auburn	Hudson	Packard
Ausha	Hupmobile	Pierce
Buick	Lafayette	Arrow
Cadillac	La Salle	Plymouth
Chevrolet	Lincoln	Pontiac
Chrysler	Lincoln	Reo
Cord	Zephyr	Studebaker
De Soto	Mercury	Terraplane
Dodge	Nash	Willys

Over 600 pages; including 50 pages of carburetor text, charts, illustrations covering all models. Over 450 charts, tables: Tune-up Chart, Valve Measurements, Compression Pressure, Torque Wrench Reading, Starting Motor, Engine Clearances, Generator, Clutch & Brake Specifications, Front End Measurements, etc.; Engines, Electric, Fuel, Cooling, Lubricating Systems, Transmissions, Universals, Front Ends, Wheels, Rear Ends, etc.

## Same FREE 7-Day Offer Applies on New MoTor's TRUCK REPAIR MANUAL

For mechanics, truck specialists, service stations, fleet owners. Covers EVERY job on EVERY truck made since 1935! 1400 pictures, 900 pages, 300,000 facts. Used by Armed Forces. Warranted to contain every essential fact you need to know. Sturdy binding, size 8 1/2 x 11.

Covers all types Gasoline Engines, Diesels and Hesselmans, Fuel Systems, Governors, Lubrication Systems, Ignition Systems, Starters, Generators, Clutches, Transmissions, Axles, Torque Dividers, Transfer Cases, Brakes, Steering, etc., etc.

Offered on same FREE 7-Day examination as Auto Repair Manual. Check box in coupon at right.

**MoTor**

Published by MoTor, The Leading Automotive Business Magazine. MoTor's manuals assure high standards of repair work.



## MAIL COUPON NOW FOR 7-DAY FREE TRIAL

MoTor Book Dept., Desk 2B, 572 Madison Ave., New York 22, N.Y. Rush to me at once: (check box opposite book you want).

☐ **MoTor's AUTO REPAIR MANUAL** (formerly "MoTor's Factory Shop Manual") If O.K., I will remit \$1 in 7 days, and \$1 monthly for 4 months, plus 35c delivery charge with final payment (\$5.35 in all). Otherwise I will return book in 7 days. (Foreign price, remit \$7 cash with order).

☐ **MoTor's TRUCK REPAIR MANUAL**. (Described at left in the box.) If O.K., I will remit \$2 in 7 days, and \$2 monthly for 3 months, plus 35c delivery charges with final payment (\$8.35 in all). Otherwise I will return book in 7 days. (Foreign price, remit \$11 cash with order).

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone No. \_\_\_\_\_ (if any) \_\_\_\_\_

☐ **SAVE 35c!** Check here if enclosing full payment (check or money-order) WITH coupon. We pay 35c shipping costs. Same 7-day return privilege.



## AVIATION NEEDS MEN



### As An Aviation Specialist

Send for free booklet outlining courses

There is a constant mounting demand for TRAINED men in practically every branch of Aviation . . . RIGHT NOW There is vital, profitable work to be done by those who are qualified to take their place in this fastest growing of all industries.

A moderate investment in training now can pay you big dividends the rest of your life. Send for the complete story and plan to start on a real career soon. Fill in and mail the coupon now for details of either flight or technical courses.



**Embry Riddle**  
School of Aviation  
MIAMI 30, FLORIDA

Dept. 111, Box 111, Dept. 9, P. O. Box 111, Miami, Fla.  
about Aviation Training at Embry Riddle

- ☐ Flight Training
- ☐ Aircraft Engine Mechanic Course
- ☐ Aircraft Mechanic Course
- ☐ Aircraft Drafting & Design
- ☐ Aircraft Drafting & Production Illustration
- ☐ Radio Courses
- ☐ Master Instrument Course
- ☐ Link Instructor's Course

Name \_\_\_\_\_ Age \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

**Leading PHOTOGRAPHERS RECOMMEND**

34 years experience training men and women for photographic SUCCESS. Commercial, Portrait, News, Industrial Motion Picture, Color Photography. Resident or home study training. Personal instruction from outstanding faculty of top-notch photographers. Start immediately. Write for free book.

**NEW YORK INSTITUTE of PHOTOGRAPHY**  
Oldest, Largest, Best Equipped Photo School (Founded 1820)  
DEPT. 5 10 WEST 13rd ST., NEW YORK

Buy War Savings Bonds and Stamps regularly.

**An Audel Guide!**



## PUMPS-HYDRAULICS-AIR COMPRESSORS

JUST OUT! 3 BOOKS IN ONE—OVER 1000 PAGES, 1000 ILLUSTRATIONS, WITH QUESTIONS AND ANSWERS. COMPLETE PRACTICAL CONCISE INFORMATION FOR ALL ENGINEERS AND OPERATORS.

**PART 1—PUMPS—850 Pages:** All types—Centrifugal—Rotary—Reciprocating Pumps. Their Theory, Construction, Operation and Calculations. Air and Vacuum Chambers—Power Pumps—Air Pumps—Jet Condensers—Surface Condensers—Condenser Auxiliaries—Condenser Operation—Calculations—Cooling Ponds—Cooling Towers—Water Supply—Hydraulic Ram—Special Service Pumps—Automotive Fire Pumps—Dredges—Cores. 742 Illustrations.

**PART 2—HYDRAULICS—320 Pages:** Hydraulic Physics—Drives—Machine Control—Accumulators—Elevators—Hydraulic Airplane Control—Automobile Brakes—Shock Absorbers—Presses—Turbines. Many new uses explained. 310 Illustrations.

**PART 3—AIR COMPRESSORS—400 Pages:** Compression of Air—Compressor Classification—Parts, Types, Inter and After Coolers—Regulating Devices—Installation—Lubrication—Operation—Maintenance—Blowers—Super-Chargers—Pneumatic Hand Tools—Ready Reference Index and Tables. 462 Illustrations.

### Free Examination

TO GET THIS ASSISTANCE FOR \$4 COMPLETE YOURSELF SIMPLY FILL IN AND MAIL YOUR ORDER TODAY **4** ONLY \$1.00.

Send postpaid ALDELS PUMPS, HYDRAULICS, AIR COMPRESSORS (\$4) if I decide to keep it, I will send you \$1 within 7 days, then remit \$3 monthly until purchase price of \$4 is paid. Otherwise, I will return it promptly.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
Occupation \_\_\_\_\_  
Employed by \_\_\_\_\_ P.S.M.

## WET LEAKY WALLS quickly MADE DRY AND BEAUTIFUL

### STOPZIT is Guaranteed To Do The Job!

Here's a new fast way to transform the wettest, dingiest masonry—above or below grade—into absolutely dry walls, with a colorful surface of sparkling porcelain smoothness. Just brush on one coat of STOPZIT! Leaks are gone. You have a hard, permanent light-reflecting surface in beautiful color that is washed as easily as porcelain. STOPZIT costs as little as 10¢ per sq. ft. STOPZIT is odorless. STOPZIT does the most efficient job—easily and inexpensively. Use indoors or out on wet or dry walls painted or unpainted—right over any masonry construction, concrete brick, older block, rough plaster, etc. Made in white, ivory, cream, light gray, battleship gray, tan, blue, rose, red, green. Approved by FFA. Used by foremost contractors, home-builders, U. S. Govt. Order today specifying color you want. \$1.45 qt. \$3.95 gallon. (Gallon covers approx. 100 sq. ft.) Send check or money order—or I.O.D. plus postage. SATISFACTION GUARANTEED OR MONEY BACK!

BARRYMORE CO., Dept. B, 19 West 44th St., N.Y.C. 18



## TRI-STATE COLLEGE

### B. S. Degree in 27 Months

Distinguished for technical 24-year courses in Civil, Electrical, Mechanical, Chemical, Radio, Aeronautical Engineering, Business Administration, Accounting and Secretarial Science.

**MEN AND WOMEN—**3 yr. high school students with good record admitted. Special Preparatory Department. Short diploma courses (30 weeks) in Surveying, Drafting, Low tuition. Low living costs. Cost of tuition student body 1st year. Enter March, June, Sept., Jan. Catalog. 524 College Ave. **INDIANA**

## STUDY ENGINEERING AT HOME

With A Chartered Educational Institution

Courses in **ENGINEERING:** Electrical, Civil, Mechanical, Drafting, Architectural, Steam, Aeronautical, Radio, Structural, Mining, Industrial Highway, Petroleum, Marine, Chemical. Courses in **ARTS AND SCIENCES:** Philosophy, Education, Letters, Public Health, Medical Jurisprudence, Psychology, Sociology, Physics, Chemistry, Geology, Pol. Sci., Theology, Law, Business and Commerce, Accounting, Mathematics, Statistics, Agriculture. McKinley-Dewey Inc. 4410 N.C. Sheridan Road, Chicago 40

## THERE'S MONEY IN CARTOONS!

**\$2.85** RATE 2.85¢ a word. HOW to CREATE ORIGINAL CARTOONS at home. You may REVEAL Course materials 36 lessons and over 100 illustrations. All for only \$2.85. Send name and address for free details.

RAYE BURNS SCHOOL, Dept. 6, Box 1398, CLEVELAND 5, OHIO

## MONEY IN RABBITS-CAVIES

**WE BUY** and put you in touch with other markets. Catalog and copy of magazine 10¢. Or send 25¢ for Book Catalog and 1¢ for 1st of 100. 2 Rabbits given to the AMERICAN SMALL STOCK FARMER. OUTDOOR ENTERPRISE CO., DYER, PEARL RIVER, N.Y.

## FREE Catalog

Class pins, club pins, rings and emblems. Finest quality. Reasonable prices from 55¢ up. Write today. Dept. Q, Metal Arts Co., Rochester, N.Y.

## Get into the BAKING BUSINESS

Bakers make good money! Now 7th Industry in wages! Nearly depression-proof. New home study Baking Course gives you 100% education sufficient. If you're ambitious, write for FREE BOOK, "Opportunities in Baking." National Baking School, 1215 Michigan, Dept. 1262, Chicago





Get into this new, fast-growing field—

**PLASTICS**

We will train you  
at home for  
**PLASTICS**



Just as plastics are vital to modern transportation—in streamlined cars and trains, fighting planes and future air taxis, PT boats and cargo carriers—so also a knowledge of plastics can be vital to you . . . and can take you farther and faster in your chosen career.

There is a tremendous demand for men and women



trained in this exciting new giant industry. . . The future is so vast that some predictions seem exaggerated—almost fantastic—but the fact remains that plastics are already important parts of many major industries.

### GOOD JOBS NOW and at WAR'S END

Now a vital, growing war industry, plastics look forward to peace-time developments of unlimited scope. These new materials may be used for fabricating buildings, complete automobile bodies, intricate new machines, new systems of communication. When the war is over and competition for jobs is really keen again, will you be all ready to go ahead with an industry that's really going places? Will you have the knowledge that employers want—the training for a big-time career in plastics?

### CHOOSE YOUR INDUSTRY WHEN YOU KNOW PLASTICS

There is hardly an industry that is not using more and more plastics—or making plans for future developments based on plastics. On all sides men are being asked—who know plastics, to fill important defense industry positions as designers, fabricators, molders, superintendents, etc. Pick your industry and enter—as a plastics technician. Among the major lines of business in which plastics will be increasingly needed are: Aircraft—Automotive—Radio—Television—Machinery—Railroad—Furniture—Architecture—Telephone—Boat Building—Office Equipment—Textiles, Shoes, Scientific Apparatus—Home Building—Hardware and Interior Decoration.

### READ WHAT STUDENTS SAY

"My enrollment . . . has a ready-made me unexpected result after only 2 months of study. I have been transferred . . . to the Research Department at Douglas . . . and incidentally, at an increased rate of pay."

—R. P. C.

"The course is so thorough and efficient that I was able to step right into my position and carry on without difficulty."

—E. J. V.

Please accept my sincerest thanks . . . in providing a thorough and practical approach to the field of Plastics"—B. W. C.

## TRAIN BY AMERICA'S ORIGINAL PLASTICS SCHOOLS

You won't lose a minute from your present work. Your training for a career in plastics will fit right into your present schedule—making your increased spare time pay big dividends. Simply devote a few hours each week to enjoyable home study. If you are new to plastics, you prepare for advancement; if you are in some other field, you are qualifying for unlimited opportunities in plastics—by starting your training NOW.

### YOU CAN LEARN AT HOME EASILY

Few subjects are so well suited to home study as plastics. The Plastics Institute course tells you all about plastic materials, how and when to use them—design—molding—fabricating and dozens of other subjects—how to capitalize on the op-

portunities for men and women with plastics training. The course is illustrated with hundreds of drawings and pictures—prepared and supervised by recognized plastics authorities.

### NOW IS THE TIME TO ACT

Find out how the Plastics Institute can help YOU. Mail the coupon for your copy of the large FREE booklet "World of Plastics." It is crammed with valuable information about plastics, tells about the new plastic airplanes and other uses for this revolutionary new material . . . as well as about the opportunities for YOU in plastics. Decide NOW to let plastics point the way to YOUR success . . . send the coupon TODAY.

*Plastics*

**INDUSTRIES TECHNICAL INSTITUTE**

1220-B Chanin Bldg. New York 17 626-D LaSalle-Wacker Bldg. Chicago 1 194 So. Alameda St. Los Angeles 4

## MAIL COUPON FOR FREE BOOK

Plastics Industries Technical Institute, Dept. 5-2  
626-D La Salle-Wacker Bldg., Chicago 1

Gentlemen: Please send me the booklet "World of Plastics" and information on your training program. I understand there is absolutely no obligation.

Name \_\_\_\_\_ Age \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_









# Learn AIRCRAFT DESIGNING and ENGINEERING This New Way at Home

Men and Women Needed Now to Train For Well Paid, Essential War Work and High Class Peacetime Positions



Don't let the pressure of these busy times make you lose sight of your own future. Start to train now for a career with better pay—and unlimited opportunities for advancement. With this new "boiled down" course, from a well-known, long-established organization which has been teaching aviation and flying airplanes for a generation, you can earn a coveted Ryan diploma just by using part of your spare time. The lessons are so interesting, many students finish far ahead of schedule.

**Needed NOW—Trained Draftsmen and Engineers To Help Build America's War Planes. Needed TOMORROW—More Trained Men and Women To Help Build The New Different Revolutionary Planes of Aviation's Great Peacetime Future**

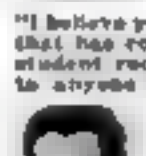
Previous training is unnecessary. You learn at home under individualized supervision. There will be no loss of any income or time from your present job. And you'll be proud to tell your friends that your school, Ryan Aeronautical Institute, is operated as an affiliate of the famous Ryan School of Aeronautics (teaching flying), and the great Ryan Aeronautical Company (designing and building airplanes). Thus your

training will be direct-from-the-industry—training which has been approved by the other large aircraft manufacturers.

## Read What These R.A.I.-Trained Men Say:



**R.A.I. TRAINING BRINGS BETTER JOB AND RAISE IN PAY**  
 "At the time I enrolled for your training I was doing stock work at Bell Aircraft. However in October I got transferred into the Tool Design Department. My pay has been increased and I hope to realize more profits later." Garwood Haybrook, Niagara Falls, N. Y.



**SAYS R.A.I. COURSE SUPERIOR TO ALL**  
 "I believe your course to be far superior to anything of this nature that has come to my attention. The personal attention which a student receives amazes me. I shall always recommend R.A.I. to anyone interested in Home Study Aeronautical Training." A. DeLandheim, Los Angeles, California



**R.A.I. GRADUATE PRAISES COURSE**  
 "I've been in the Aviation industry long enough I believe to recognize the real material when I see it. This is it. Yes, without question you have here the solution to the problem. How can I equip myself for entrance into the Engineering branch of the Aviation industry?" William B. Evans, La Jolla, California.

## Complete Aeronautical Drafting Outfit At NO EXTRA COST

Every R.A.I. student gets this complete, professional drafting equipment set, without additional charge. There is nothing else to buy—no extra costs to bother you as you progress toward your valuable diploma—your ticket to a new, exciting, high paid career.



**RYAN Aeronautical Institute**  
 412 Lindbergh Field, San Diego, California

Gentlemen:

Please send me, without any obligation on my part, your FREE 24-page book, "NEW HORIZONS OF OPPORTUNITY," with 60 illustrations, and full information on R.A.I., including cost of training, and on job opportunities both before and after graduation.

Name \_\_\_\_\_ Age \_\_\_\_\_  
 Street \_\_\_\_\_  
 City \_\_\_\_\_

## Do This—Then Judge For Yourself

Your time is the most valuable thing you have. You owe it to yourself to see that the study course on which you spend your time is the finest—the practical. So use this coupon—now! There is no obligation—it'll take but a minute—and it may easily be the first step in opening the door to higher pay than you've thought possible—to being looked up to for the important interesting work you do.



**Free!** This Valuable Book  
 24 Pages, 60 Illustrations  
 Full Information and Costs



The set of  
books  
that makes  
**MASTER MACHINISTS**  
and leads to bigger pay!

This big home-study and reference course gives you the practical facts on machines and methods you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency, with

**The AMERICAN  
MACHINISTS' LIBRARY**

8 volumes—2368 pages—2516 illustrations  
(A combined home-study course and reference library)

This library of machine shop practice was written for practical men. It gives you the best methods for every kind of machine shop work. It fully explains lathes, drills, and other machine tools and their operation, automatic screw machines, speeds and feeds, gear design and production, jigs and fixtures, punch and die work, metal surfacing, etc., etc. Plainly written—completely illustrated—the best kind of help to the machine shop man who wants to improve himself.

No money down—special price—easy payments.

**EXAMINATION COUPON**

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C. 18

Send me for ten days, examination the American Machinists' Library. If satisfactory I will send you \$1.50 in 10 days and \$3.00 monthly until the price of \$19.50 is paid. If not wanted I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name . . .  
Home Address . . .  
City and State . . .  
Position . . .  
Name of Company . . . PSM 2-44

**HERE'S THE**

**HOSPITALIZATION PLAN**  
YOU'VE BEEN LOOKING FOR!

**ONLY 3c A DAY GIVES  
YOU THESE REMARKABLE  
BENEFITS IN CASE OF  
SICKNESS OR ACCIDENT**

Hospital Expenses  
paid, up to  
**\$540**

Doctor Expense paid,  
up to  
**\$135**

Loss of Wages  
retained, up to  
**\$300**

Loss of Life  
by Accident  
**\$1,000**

War coverage and  
extra benefits

Don't wait for trouble to strike! Many a man's savings of years have been wiped out by a few weeks of misfortune. Take out our liberal hospitalization policy now and know that your doctor and hospital bills will be paid. Only 3 cents a day gives you a freedom of mind worth far more. Individuals of whole families (to age 70) are eligible, and you may go to any U. S. or Canadian hospital, under any physician's care.

MAK COUPON TODAY. No agent will bother you.

Family Mutual Life Insurance Co.,  
Wilmington, Del.

PS-1

Please send without obligation to me complete information on your Family Mutual Hospitalization Plan

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_



SEND FOR THIS  
TIME SAVING **OHMITE**  
Ohm's Law Calculator



Figures Ohms,  
Watts, Amperes  
Volts... Quickly!  
Any Ohm's Law  
Problem solved  
with one setting

of slide. All values direct reading. (4 1/8" x 9")  
Send only 10c in coin to cover cost of handling.  
**OHMITE MFG. CO., 4943 Flournoy St., Chicago 44, Ill.**

**ENGINEERING DEGREE IN  
27 MONTHS**

INDIANA  
TECHNICAL  
COLLEGE

Courses in Aeronautical, Chemical, Civil, Electrical, Mechanical, and Radio Engineering. One-year courses in Radio and Drafting. Government-approved Ground School courses. Prep courses without added cost. Low tuition. Large industrial center. Opportunity to earn part living expenses. Enter March, June, September, December Catalog. 624 E. Washington Blvd., Ft. Wayne 2, Ind.

**DO YOU**

WANT a permanent business profession of your own? Then become a foot corrector. Earnings of men and women in this greatly needed profession

run as high as \$60.-\$100. weekly after a few weeks home training—not medical or chiropody—easy terms, no further capital needed, no goods to buy 47th year. Write for free booklet.

Stephens System of Foot Correction, 82 Back Bay, Boston, Mass.

**Make  
BIG MONEY AT HOME!**  
**NEW  
Invention**  
**Electroplates  
by BRUSH**



**Now Plates CHROMIUM!**

ALSO GOLD, SILVER, NICKEL, COPPER, ETC.

**Big Demand—You Profit!**

New, patented invention makes possible big earnings AT HOME. Replate auto-parts—worn articles in homes, stores, hotels, restaurants, etc., with durable, sparkling, new coat of metal—with stroke of brush. Easy, simple, quick. Genuine Gold, Silver, Nickel, Cadmium, etc. Everything furnished. Outfit complete, ready for use. No shop required. Clear from \$2 to \$5 an hour in lifetime business. Small investment starts you in business. Steady repeat. Machine can pay for itself in week. Send TODAY for FREE SAMPLE and illustrated BOOKLET how you can have a life income from a business of YOUR OWN built upon satisfied customers. Act at once!

**WARNER ELECTRIC COMPANY**

663 N. Wells St., Chicago, Ill., Dept. 410

**FREE BOOK & SAMPLE**

WARNER ELECTRIC CO., 663 N. Wells St., Chicago, Ill., Dept. 410

Gentlemen: Send me Free Sample and Illustrated Booklet.

Name \_\_\_\_\_

Address \_\_\_\_\_

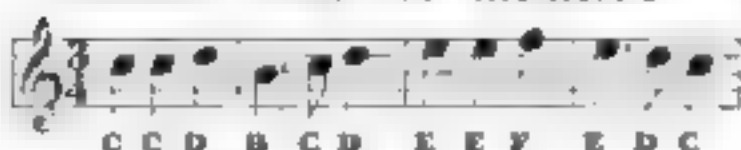
City \_\_\_\_\_ State \_\_\_\_\_

Buy War Savings Bonds and Stamps regularly.

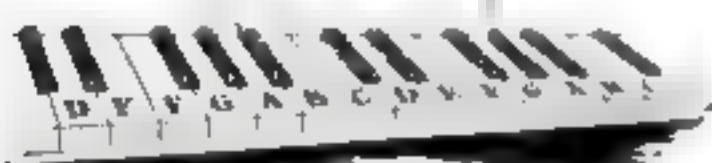


# To those who think LEARNING MUSIC is hard...

SEE HOW EASY IT IS!  
MY COUNTRY 'TIS OF THEE,  
SWEET LAND OF LIBERTY



C C D B C D E E F E D C



Strike these notes and you're playing  
"America." TRY IT—IT'S FUN



## Easy as A-B-C this print and picture way

• Perhaps you think learning music is a tedious grind. It isn't any longer! Long hours of practicing humdrum scales and hard-work exercises are over and done with.

You have no excuses... no alibis whatsoever for not getting started toward musical good times now! For, through a new, easy, pleasant method, you can now learn to play right at home—without a private teacher—for only a few cents a day.

### Learn to Play by Playing

The lessons come to you by mail from the famous U. S. School of Music... complete instructions, large, clear diagrams and all the music you need. You study with a smile. You learn to play by playing real tunes by note. And it's all so easy to understand. First you are told how to do a thing. Then a picture shows you how. Then you do it yourself and hear it.

If you're tired of just looking on at parties—if you've envied those who could enter-

tain others—if learning music has always been a never-to-come-true dream—let this time-tested home-study method come to your rescue.

Over 750,000 people have studied music this modern, easy as ABC way. And remember, no matter what instrument you choose, the cost will average only a few cents a day.

Our Illustrated Free Booklet fully explains this remarkable course. It shows how you can learn to play quickly, and for a mere fraction of the cost of old, slow methods. So decide which instrument you want to play and mail the coupon today. The fascinating Free Booklet will be sent to you at once together with a "Print and Picture" Sample. U. S. School of Music, 82 Brunswick Bldg., New York 10, N. Y.

### FREE! PRINT AND PICTURE SAMPLE AND ILLUSTRATED BOOKLET

U. S. School of Music, 82 Brunswick Bldg., N. Y. 10, N. Y.  
Please send me Free Booklet and Print and Picture Sample.  
I would like to play instrument checked below.

(Do you have instrument...)

Piano	Accordion	Trumpet	Ukulele
Violin	Mandolin	Trombone	Clarinet
Guitar	Saxophone	Tenor Banjo	Other Instrument

(PLEASE PRINT)

Name.....

Street.....

City..... State.....

Note: If you are under 14 yrs. of age parent must sign coupon.

Save 3c—Stick Coupon on penny postcard



Enrolling for 3rd Course

"I learned more from your course than many of my friends who studied under private teachers have for years. The fact that I've already taken 2 courses and am now enrolling for a third should speak for itself."

\*F. A. S., Indiana



Plays from Start

"Your advertisements are true to the letter. I can actually play my favorite instrument even though I'm only at the beginning. How can I ever express my joyful gratitude?"

\*F. R. O., Illinois

\*Actual names on request.  
Pictures by Professional Models.



# KEY TO A PRACTICAL UNDERSTANDING OF ELECTRICITY

• AUDEL'S HANDY BOOK OF ELECTRICITY

**\$4** HANDY SIZE

For Engineers, Electricians, Students and all interested in Electricity. A quick, simplified, ready reference, giving complete instruction and practical information. Easy to understand. A reliable authority and a handy helper that answers your questions.

## • INSIDE TRADE INFORMATION ON

The Rules and Laws of Electricity—Maintenance of Machinery—A. C. and D. C. Motors—Armature Winding and Repair—Wiring Diagrams—House Lighting—Power Wiring—Cable Splicing—Meters—Batteries—Transformers—Elevators—Electric Cranes—Railways—Bells—Sign Flashers—Telephone—Ignition—Radio Principles—Refrigeration—Air Conditioning—Oil Burners—Air Compressors—Welding, and many Modern Applications explained so you can understand.

1340 PAGES 2600 ILLUS. **SEND NO MONEY.** Just send your name and mail the FREE COUPON below.

THRO. AUDEL & CO., 40 West 23rd Street, New York  
Please send me "Audel's Handy Book of Practical Electricity" for free examination. If satisfactory, I will send you \$1 in 7 days, then \$1 monthly until \$4 is paid. Otherwise I will return it.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
Occupation \_\_\_\_\_  
Reference \_\_\_\_\_ P.S.M.



READ FOR PROFIT!

## Do you want

→ ..to go to College?

→ ..or to enter a Profession?

(Such as Accounting, Architecture, Nursing, Dentistry, Teaching, Social Work, Osteopathy, Beauty Culture, Optometry, Embalming, Chiropody, Law, Medicine, etc.)

→ ..or get an Office Position?

To get anywhere, you practically MUST finish High School FIRST. You can complete our simplified High School Course in **SEVEN** months at home, as FAST as your time and abilities permit. Equivalent to resident school work prepares you for college, pre-professional examinations, business, industry. Standard tests furnished. Diploma. Credit for H.S. subjects already completed. Single subjects if desired. Low tuition, easy terms. American School, Chicago, est. 1897—endorsed by educators. Finish your high school education NOW Write TODAY!

## High School Course at Home

Many Finish in 2 Years

American School, Dept. H246, Oriental Ave. at 56th St., Chicago 37

Gentlemen: Send me FREE information covering special training in subjects checked below. No obligation on my part.

- |  |  |
|--|--|
| <input type="checkbox"/> High School Course          | <input type="checkbox"/> Diesel Engineering                      |
| <input type="checkbox"/> Cost Accounting for Mfg.    | <input type="checkbox"/> Drafting and Design for Men and Women   |
| <input type="checkbox"/> Architecture and Building   | <input type="checkbox"/> Plastics                                |
| <input type="checkbox"/> Automotive Engineering      | <input type="checkbox"/> Private Secretary                       |
| <input type="checkbox"/> Business Management         | <input type="checkbox"/> Mechanical Engineering                  |
| <input type="checkbox"/> Electrical Engineering      | <input type="checkbox"/> Aviation <input type="checkbox"/> Radio |
| <input type="checkbox"/> Elec. and Gas Refrigeration | <input type="checkbox"/> Salesmanship                            |
| <input type="checkbox"/> Air Conditioning            | <input type="checkbox"/> Shipbuilding                            |
| <input type="checkbox"/> Railway Training            |  |

Name .....

Address .....

## HOW TO GET AND KEEP



## GOOD EYESIGHT

Do you want perfect 20/20 vision? Would you like to throw away your glasses? Great numbers of men, women and children have improved and strengthened their eyes by using the famous Ross-Rehner Method a tested and proven system of home eye exercises for correcting nearsightedness, farsightedness, color blindness and astigmatism.

## Get Better Eyesight—Without Glasses

Now you can get the entire system profusely illustrated, including a complete Eye Testing Kit, with charts to show weekly improvement. If your book store does not have it, send one dollar. Delivered postpaid, subject to return in 5 days if you are not satisfied. Order today.

**HALL PUBLISHING CO.**  
BLOOMFIELD HILLS 4, MICHIGAN

SAVE YOUR EYES



## PLAY GUITAR LIKE THE COWBOYS DO... 8

Just one—very latest guaranteed, simple, easy method. Play cowboy songs the Western way in a few minutes by ear. Surprise and amaze your friends. He is big demand at parties, camps, public entertainments, on the radio, etc. 12 Complete Lessons. **SEND NO MONEY.** Pay postman only \$1.00. \$1.00 and get EXTRA SONGS all postpaid. Cash in \$1.25 money order only. Nothing else to buy. Positive money back guarantee. Rush order today.

**WESTERN RANGER STUDIOS, Dept. 252, Hutchinson, Kans.**

## Learn TOOL DESIGN

Qualify quickly as Machine or Tool Designer through spare time home study. Many making \$100 to \$225 a week. Its pending industry calling for more machine and tool designers than available. Rush name and address today for facts on Machine or Tool Design. State age.

**OHIO INSTITUTE OF TECHNOLOGY Box 340, Greenville, Ohio**

## MASCOT SLIDE RULE

Fits the pocket. Quickly solves any problem in multiplication, division, proportion. Gives the square, the square root, logarithm and reciprocals of all numbers. Trig scales give sines and tangents of numbers. Fine black graduations on white celluloid. Price in fabricoid case \$1.00, in leather case \$1.25. Money back if not satisfied. Special offer to agents and dealers.



**TAVELLA SALES CO., 21-W West Broadway, New York 7, N.Y.**

## What Every Mason Wants



We have Masonic books and lodge supplies for Blue Lodge, Chapter, Commandery, Scottish Rite, and Shrine.

**OUR RITUALS ARE USED THE WORLD OVER**

Send for free catalog of books and rituals for Masons, Odd Fellows, Knights of Pythias, Knights of Columbus, Etc. etc. **EZRA A. COOK, Publisher, P. O. Box 796, St. Chicago 90, Ill.**

## MEN, Feel Years Younger!

Amazing centuries-old Hindu Secrets stimulate entire system, restoring youthful pep, strength and vigor in many cases. No medicine. No operations. Benefits assured on Money Back Guarantee. **FREE** information sent in plain, sealed envelope. Send name, address today to **Basic Science, 575 Elliot, Denver 4, Colorado.**

## SUPER JU JITSU



## NOW GET TOUGH DOUBLE-QUICK!

Learn how YOU can be dangerous. Lick brutes twice your size with only your bare hands, even when they are armed. This powerful fighting system is unbelievably efficient. You don't need ox-like muscles — it's brains that count! New, easy self-study course at amazing low price. Free trial offer and money-back guarantee. Hurry! Write today for **FREE DETAILS.** Nelson Co., 321 S. Wabash, Dept. B-503, Chicago



# SURPRISE YOUR FRIENDS WITH these **TWO HOLDS** used in **COMMANDO JIU-JITSU**



1 Opponent holds you off and starts to swing with right hand. 2 Press his hand hard against your chest with both of yours - take short step back and bend over suddenly forcing him to ground. Practice with

caution to avoid breaking his wrist 3 Opponent attempts to choke you from rear. Raise your right hand high. 4 Pivot to right bring your arm down fast, locking his arms against you.



*Malay  
Jungle*

## CHOKING STICK **FREE**

WITH EVERY COPY  
OF

**THIS** is the authentic picture course in Commando Jiu Jitsu with every old and new hold, blow and throw illustrated in clear drawings and actual photographs. It takes the mystery out of Jiu Jitsu and makes it easy for anyone to learn quickly. Just a few hours practice will make you a master of enough holds to give you protection from bullies, thugs or hoodlums even twice your size and weight.

### FIRST TIME PUBLISHED

New Tricks learned from Savage Malay Jungle Fighters.

Exact instructions fully illustrated for using the vicious and deadly Malay Choking Stick. Defenses, holds, throws, and disabling blows never before put in published form. A few "flash" moves with the Malay Choking Stick makes you master of any situation. NOTE: Must not be placed in the hands of children or irresponsible persons. Practice with this Jungle Choking Stick must be done with great care or serious injury

may result. This is not a plaything, but a deadly weapon.

A few hours spent now practicing Commando Jiu Jitsu may save your life or your property when you are attacked—or may save you or your loved ones from severe injury. The real heroes are not the men of brawn, but the ones who have the "know how"—men who can use their heads in a cool, sure, swift, and knowing way when the emergency calls for someone to step forward and take the situation in hand.

### RUSH FREE COUPON

before supply is gone. We have a limited supply of Jungle Choking Sticks—same size and type as used in Malay Jungle and exactly the same as used for illustrating this Commando Course in Jiu Jitsu. A practical, useful, weapon that makes a one man "batt" in the hands of those who learn to use it.

Don't wait until the supply of Choking Sticks is gone. Send now. Fill in the coupon, send cash, money order or check, and we will prepay postage. Or if you prefer put an X in the COD square and we will ship Commando Book AND Choking Stick, both "man of the hour" when the time comes.

**WILCOX & FOLLETT CO., Dept. 32**  
1255 S. Wabash Ave., Chicago 5, Ill.

Send me your new Defense Manual of Commando Jiu Jitsu, including more than 140 photos and drawings of men and women, and including the never before published blows, holds, and throws, now made possible by use of the Jungle Choking Stick. You will also send **FREE** (if EXTRA CHARGE) one Jungle Choking Stick for practice. Total cost \$1.98.

☐ I enclose remittance for \$1.98. You will prepay postage.

☐ Send above G.H.D. for \$1.98 plus \$1.00 fee, and charges. I will pay postman.

Name .....

Address .....

City .....

State .....

Orders from Canada must include full remittance in U.S. Exchange.



**\$1.98**

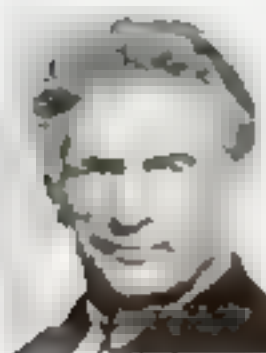
**COMPLETE**  
Includes Course  
AND Choking  
Stick Free of  
Extra Charge

### FREE

No extra charge to those who order now. The vicious and deadly weapon of the Malay Savages—the Jungle Choking Stick. Small supply. One stick will be sent free with each Manual while they last.

**WILCOX & FOLLETT CO., Dept. 32**  
1255 S. Wabash Ave., Chicago (5) Ill.





Bernard Macfadden, founder and originator of Physical Culture Magazine—now again on sale in a new format at all newsstands.

LET  
*Bernard Macfadden*  
HELP YOU

## STRENGTHEN YOUR EYES

With this Remarkable Series of Exercises

Are you bothered with eye strain? Like thousands of others, you may relieve overworked, suffering, tired eyes if you follow the advice of Bernard Macfadden. Remember, Mr. Macfadden, at 75 years of age, has perfect vision—needs no glasses! Now you can know some of the secrets of eye strengthening he has discovered.

This course of exercises comes to you in a 21x22-in. easy-to-read chart in color, complete with easy-to-understand instructions. They'll amaze you with their beneficial results. Send for yours to-day!

**SOLD WITH AN UNCONDITIONAL MONEY-BACK GUARANTEE—ONLY \$1.00**

So sure is Mr. Macfadden that after a short time you probably will be able to feel tangible results from these exercises that he offers them to you with an unconditional money-back guarantee. If you are not satisfied, you may return chart within 10 days and your money will be refunded. **AREN'T YOUR EYES WORTH A DOLLAR BILL TO YOU?**

**SEND NO MONEY**

Merely pay the postman \$1.00 plus 12c postage and handling charges. Or—if you send your check or money order of \$1.00 with the coupon, we will be glad to pay postage.

MACFADDEN FOUNDATION, DEPT. 32

833 FIFTH AVENUE, NEW YORK, 17, N. Y.

Please send me Bernard Macfadden's "Thousand Shift" eye course. I will pay the postman \$1.00 plus 12c postage and handling charges ☐ I enclose \$1.00 (check or money order) ☐

Name .....

Address .....

City .....

State .....

# LAW

STUDY AT HOME for PERSONAL SUCCESS and LARGER EARNINGS. 12 years expert instruction over 100,000 students enrolled. LL.B. Degree awarded. All textbooks and study materials. Send for FREE BOOK "Law and Executive Guidance."

AMERICAN EXTENSION SCHOOL OF LAW  
Dept. 38-3, 8 East Huron St., Chicago, Ill.



## DRAW for MONEY

### BE AN ARTIST!

Trained Artists are Capable of Earning \$30, \$50, \$75 a week

Use Your Spare Time to Prepare for a Profitable Art Career! **COMMERCIAL ART, DESIGNING and CARTOONING**—all in ONE complete home study course. No previous Art experience necessary—we teach you step by step—hundreds have profited by our practical method. **TWO ART OUT-FITS FURNISHED.** Full information in colorful **FREE BOOK** "Art for Pleasure & Profit"—tells all about our course, service what our graduates say, and commercial opportunities for you in Art.

**FREE BOOK gives details!**

WASHINGTON SCHOOL OF ART  
Studio 122 N. 1115 15th St., N. W. Wash. D. C.  
Send me your booklet and full particulars about your course.

Name .....

Address .....

City .....

State .....

1" POCKET-SIZE A-B-C-EI-S-S-L-V SCALE

**NEW 6 INCH SLIDE RULE**  
Lightweight, Laminated PLASTIC 7 ADDED FEATURES

Never before offered Plastic cannot warp or break, stays accurate, engine-turned calibrations can't rub off. Handy also with all scales in figure and arithmetic, multiplication, division, geometry, engineering problems; 1000 other uses. Has 6" and metric rule; conversion tables for decimals, fractions, weights—quantity, liquids, BTU, HP, areas, linear-metric, etc.

**MULTIPLY, DIVIDE, DO ANY MATH PROBLEM EASY, QUICK, WITHOUT PENCIL OR PAPER**

Mechanics, shipbuilders, draftsmen, technicians, engineers, tool and die makers speed work. Bartenders use for change finding, bartenders, logicians, etc. Accountants, businessmen, clerk, figure work-ups, profits, investments, students, anyone can be mathematical wizard. 8-page illustrated Instructions folder shows how.

**SEND NO MONEY**  
Pay postman 79c for one, \$1.50 for two, with instructions, plus few pennies postage and C. O. D. charges. **MONEY BACK GUARANTEE** Or send Money Order or **ACADEMIC SLIDE RULE CO.** Cash and we pay postage. **CARR. LL. CH. O. DIFT. KS**

Includes "Easy to Use" INSTRUCTIONS  
and the makers speed work. Bartenders use for change finding, bartenders, logicians, etc. Accountants, businessmen, clerk, figure work-ups, profits, investments, students, anyone can be mathematical wizard. 8-page illustrated Instructions folder shows how.

**WAS WORKERS**  
Increase efficiency use the slide rule. Keep job after War!

**THIS RULE HAS EVERYTHING**

## RADIO

ENGINEERING, Broadcasting, Servicing, Electronics, Aviation, Marine & Police Radio taught thoroughly 48 weeks' Engineering course equivalent to 3 years' college radio work. All expenses low. Co-educational. Catalog free

Valparaiso Technical Institute, Dept. 503 Valparaiso, Ind.

## AUTO-HYPNOSIS: Key to Success!

Surprising new easy way to personal success and achievement. Learn how you can concentrate, control and utilize your tremendous latent mental powers to gain health, wealth and every desire. Send today for free information, Science Fellowship, 878 Elliot St., Denver 4, Colorado.



Write for my Free Book "How to Become an Expert Penman" which shows what others have accomplished by taking my course. You get 10c for one of my Penmanship books and you receive with a beautiful fountain pen and a card. Write today. T. M. TEVIE, Box 238, Chillicothe, Mo.

**LEARN MEAT CUTTING**  
At Home—in Spare Time

Learn to cut meat at home in your spare time. No need to leave home. No need to travel. No need to pay for tuition. No need to pay for books. No need to pay for anything. Just write for free information. National School of Meat Cutting, Inc., Dept. O-17, Toledo 4, O.

**TRAIN Your VOICE!**

Results **GUARANTEED**

We build, strengthen the vocal organs—not with singing lessons but by sound, scientifically correct silent and vocal exercises and absolutely guarantee complete satisfaction with results. Write for Voice Book, FREE. Send to no one under 17 unless signed by parent.

**PERFECT VOICE INSTITUTE, Studio 1362 64th Lake St., Chicago 116.**



**M E N**

This Horse-Shoe Ring, hand-made, hand-engraved, inlaid with simulated pearl, is a **KNOCK-OUT!** Shoe and shank of everlasting Monel Metal is **GUARANTEED 20 YEARS**

Supply is limited... rush your order! **SEND NO MONEY.** Pay postman only \$3.98 plus excise tax and postage. Return for refund in five days if not delighted.

**AMERICAN JEWELRY CO.,**  
Dept. 10-H, Wheeling, W. Va.



# GET INTO RADIO



## ELECTRONICS TELEVISION *Now!*

Shortages in trained, skilled men run into the hundreds of thousands. One of the biggest fields is RADIO, with its many fascinating branches. Wartime demands for Radio men are tremendous and will continue UNABATED after the war. That's important to you. You want training in a field that will continue to advance. National Schools offers you a time-tested method of Home Training which has helped thousands of men to more pay, and unlimited opportunity in the growing RADIO industry.

You profit by a fascinating career in Radio, Radionics, Electronics, Television.

## Shop Method Home Training by a Long Established Resident School

Get Ready For Your Opportunity

It's Here! Radio technical men are needed everywhere—afraid in action, and at home in industry! Trained men are needed in the Army, Navy and Air and Signal Corps, Government Defense Service and Civilian fields. Now in answer to repeated demands for Trained Radio Technicians, National Schools has extended its famous Shop Methods so you can qualify right at home. You can quickly prepare to be of greatest service to your country and yourself. Yes, right at home, in your spare time. National's time-tested plan of Home Training will definitely establish you, in a

short time so you can hold a good job in this fascinating field. Furthermore, you become equipped for an ever bigger career in the years of reconstruction after the war.



### TRAIN DURING MILITARY SERVICE

Prepare for Radio Service in Army and Navy. In U.S. Gov't service you install, operate and maintain most technical equipment such as secret ultra-high frequency apparatus to locate airplanes, submarines, etc. Get promotion in rank and increased pay almost from the start.

### Command Any Of These Jobs

Radio Expert  
Electronics Engineer  
Radio Broadcasting  
Studio Technician  
Television Technician  
Aviation Radio  
Ship & Harbor Radio  
Business of Your Own  
137 Different Types  
of Jobs to Choose  
From

### Duplicate The Success Of These Graduates

"National Schools has done wonderful work for the man who wants to get ahead in life. Your trained man can get a job at a much higher salary." —O. K. Ivey, Washington, D. C.

"Your schooling helped me obtain a swell job. Now in the navy I am following the profession I learned at National. It will help my chances for rapid advancement." —H. Schroeder, U. S. Navy

## TREMENDOUS POST WAR DEMAND No Previous Experience Needed!



Radio is only one of the courses you receive when you become a National Student. Electronics is brand new and open to every trained radio man. After this war it will produce new marvels that will be needed and used in every home. General Electric, Westinghouse and all great manufacturers have many new electronic inventions ready to market. National men, because of their knowledge and training in Electronics, will be in on the ground floor and among the first to cash in. Television is a big new opportunity. National men will have the "know how" to merit jobs in this great industry.

You work with the finest tools and materials furnished by us at no extra charge.

## NATIONAL SCHOOLS

LOS ANGELES 37, CALIFORNIA  
EST. 1905



## FREE LESSON

### AND OPPORTUNITY BOOK

To prove that you can easily learn radio at home by National's famous "Shop Method" home training, we will send this **SAMPLE LESSON** without cost or obligation. With it, we will send you a big, 36 page book, "Your Future in Radio, Television and Electronics." Mail the coupon NOW.



### MAIL OPPORTUNITY COUPON FOR QUICK ACTION

National Schools, Dept. 2-PSR  
4000 S. Figueroa Street  
Los Angeles 37, Calif.

Mail in envelope  
or paste on penny postal

Please rush me FREE and without obligation on my part Sample Lesson in Radio, Television and Electronics and full details of your "Shop Method" of home training. No salesman will call.

NAME \_\_\_\_\_ AGE \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_



# 9 BIG BUILDING BOOKS



**SHIPPED  
FREE FOR  
EXAMINATION**

Learn to draw plans, estimate, be a live-wire builder, do remodeling, take contracting jobs. These 9 practical, profusely illustrated books cover subjects that will help you to get more work and make more money. Architectural design and drawing, estimating, steel square, roof framing, construction, painting and decorating, heating, air-conditioning, concrete forms and many other subjects are included.

## BETTER JOBS — BETTER PAY

Keep busy now at good pay, and be prepared for after-war building boom. Big opportunities are always for MEN WHO KNOW HOW. These books supply quick, easily understood training and handy, permanent reference information that helps solve building problems.

## UP-TO-DATE EDITION

These books are the most up-to-date and complete we have ever published on these many subjects.

## Coupon Brings Nine Books FREE For Examination

AMERICAN TECHNICAL SOCIETY (National Publishers since 1898)  
Dept. Q-220, 3801 N. 4th Street, Chicago 27, Illinois

You may ship me the Up-to-Date editions of your nine big books, "Building, Estimating, and Contracting," without any obligation to buy. I will pay the delivery charges only, and if fully satisfied in ten days, I will send you \$7.00, and after that only \$3.00 a month, until the total price of only \$39.00 is paid. I am not obligated in any way unless I keep the books.

Name

Address

City  State

Please attach a 3-cent stamp for each book to this coupon, and a 1-cent stamp for each book to the address label. Please send me a set of these labels. I will send you a set of these labels. I will send you a set of these labels.

# NOW!

## Get this

# \$5,000.00

## for ONLY \$4.90 a month

### AT AGE 25

Or buy \$1,000.00 or more of this Safe & Life plan. Receive Protection for \$4.90 per month or \$5,000.00 at 25 or women at ages 21 to 55 at proportionately Low Rates!

## Twice as Much Protection for the Next 4 Years!

**Policy Provides: —**  
Full Payment in case of death,  
Cash and Loan Values  
Paid-up and Extended Insurance.  
Life Income from Proceeds,  
Current Dividends  
**9 1/2%**  
of annual premium

This policy provides about twice the protection per year than any other policy of the same face. You will be paid more than you would pay if you applied to us for an Ordinary Whole Life Policy then!

**Buy Old Line, Legal Reserve Life Insurance DIRECT!**  
For nearly 40 years, the Old Line Company, oldest among leading Old Line Life Insurance Companies, has offered Standard Life Insurance direct to the policyholder by mail and over the counter. Substantial Americans have applied for millions of dollars of Old Line Insurance. We have paid out more than \$1,000,000 to policyholders and their beneficiaries. More and more people are buying insurance direct!

## Buy Direct! Clip and Mail Coupon Now!

Postal Life Insurance Company, 511 Fifth Ave., Dept. M, 273, New York 17, N. Y.  
Mail me without obligation complete information about your low-cost Modified "A" Policy at my age.

Date of Birth  Occupation

Name

Street

City  State

Include P. O. District Number if any



Buy War Savings Bonds and Stamps regularly.



# DRAW CARTOONS BIG MONEY!

**EASY... PLEASANT WORK!**  
Let CHAS. H. KUHN, with 25 years actual experience in drawing a daily newspaper cartoon, teach you how to create, draw and sell your work. 52 complete lessons—one sent each week. Professional criticism on every lesson. Write today.

**KUHN SCHOOL OF CARTOONING**  
420 MURPHY BUILDING Dept. S, INDIANAPOLIS 4, INDIANA

# LEARN AT HOME TO MOUNT BIRDS

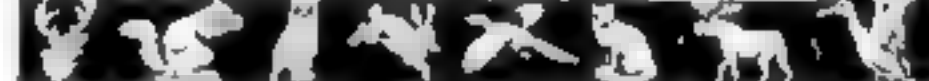


Animals, Birds, Fishes, Pets; to TAN. Be a Taxidermist. Profit and FUN.

Hunters, save your valuable TROPHIES. Mount ducks, squirrels, everything. Learn to TAN for leather and furs. Wonderful HOBBY. Have a HOME MUSEUM. BIG PROFITS mounting business. **WRITE TODAY!**

**FREE BOOK** With 100 fine game pictures. NOW absolutely FREE. Write TODAY.

Send Postal TODAY for FREE BOOK. State AGE. R.W. SCHOOL OF TAXIDERMY, Dept. 3392, Omaha, Neb.



# New Designs In FRANZITE GRIPS

Modernize Your Gun! Improve Your Score!

Most durable grips made. Positively unbreakable! For Colt, Smith & Wesson, Hi-Standard, Urig, va, Luger & Mausers in a wide choice of beautiful designs in ivory, pearl, walnut, onyx, etc. Low prices. FREE CATALOG. Dealers Wanted.

SPORTS, INC., (Mfr.) 2356 N. Clark St., Dept. S-2, Chicago, Ill.

## Learn to Write

Begin today. Write now for our Free Book. How to Write a Good Letter. This book will show you how to write a good letter. It will show you how to write a good letter. It will show you how to write a good letter.

**THE TANNEN SCHOOL OF PENMANSHIP**  
4419 Ridge Building, Kansas City, Mo.

## 5¢ EACH

## LITTLE BLUE BOOKS

Send no card for our free catalogue. 10 books of big gains. Address: **HALDEMAN-JULIUS CO. Catalogue Dept., Over M-1048 OWARD KANSAS**

# IF I Send YOU THIS SUIT FREE BONUS

Will You Wear it and Show it to Friends?  
The fact is, you can't wear a suit that is not made of the best material. You can't wear a suit that is not made of the best material. You can't wear a suit that is not made of the best material.

**STONEFIELD 1300 W. Harrison Dept. B 824 Chicago**

# Kidneys Must Clean Out Acids

Excess acids, poisons and wastes in your blood are removed chiefly by your kidneys. Getting up Nights, Burning Passages, Backache, Swollen Ankles, Nervousness, Rheumatic Pains, Dizziness, Circles Under Eyes, and feeling worn out, often are caused by non-organic and non-systemic Kidney and Bladder troubles. Usually in such cases, the very first dose of Cystex goes right to work helping the Kidneys flush out excess acids and wastes. And this cleansing, purifying Kidney action, in just a day or so, may easily make you feel younger, stronger and better than in years. An iron clad guarantee insures an immediate refund of the full cost unless you are completely satisfied. You have everything to gain and nothing to lose under the money back guarantee so get Cystex from your druggist today for only 35c.



As the industry grows, the art of course grows. **MANUALS OF PRACTICAL ART** for a person is expected by a student to be an essential part of his education. It is a book in which the student will find an aid and enjoyment in his studies. It is a **REFERENCE BOOK** and a source of information.

[illegible][illegible]

**EXAMINE  
FREE!**

You take absolutely  
no risk—no mail the  
screen NOW!

Merely mail the coupon below. When your copy of *It's Fun To Draw* arrives—read and test it for 5 days. If, after this examination, it hasn't opened up new paths of fun and artistic ability for you—return it, and it won't cost you a single penny. If you decide to keep it, the FULL PRICE is only \$1.60.

Enrichthocker Pub Co. Dept X 25  
120 Greenwich St New York 6, N.Y.  
I am a boy 14 years old I may return back and get a  
money for a  
I enclose \$100 in full payment and please  
send me a copy I will pay postman \$1.00 per  
month

姓名: \_\_\_\_\_  
 地址: \_\_\_\_\_  
 电话: \_\_\_\_\_



# 10 POWER TELESCOPE

Here's America's Newest 10 POWER TELESCOPE value. Don't confuse it with small, "week-vision" telescopes. It's precision made and measures full 16 inches. Focuses instantly on stationary or moving objects. Brings far away objects 10 times closer. Clear—sharp—BIG as life. You'd expect to pay up to \$10.00 for such power. Everyone should own a powerful telescope. Spot airplanes—identify distant objects, people, animals, etc. Valuable to Air Wardens, Boy Scouts, Sailors, Sportsmen. Ideal for fights, ball games, races, outdoor events. Enjoy front row seats from way back.

**BRINGS OBJECTS 10 TIMES CLOSER**

**Only \$1.49**

**SEND NO MONEY**

Just clip this ad and mail. Then pay postman only \$1.49 plus few cents postage on arrival. Use the Telescope for 10 days without risk. If you aren't positively thrilled, return in 10 days and we'll refund your money in full. Supply is limited due to priorities. So rush your order today.

**FREE!**  
Valuable Airplane Chart Free if you order promptly

Illinois Merchandise Mart, Dept. 55-A, 500 N. Dearborn St. Chicago 10, Illinois

# BLUEPRINT READING

**GET OUT—FOR THE MAN WHO WANTS FROM BLUE PRINTS**

"The Blue Print of Today is the Machine of Tomorrow." **AUDELS ANSWERS ON BLUE PRINT READING** covers All Types of plan reading including AIRCRAFT & SHIP BUILDING—tells How to Easily Understand Working Drawings.

What to look for first. Tells what each Line and each Symbol Means. The relation of one part to another. How to Understand Scales & Specifications. How to Make a Sketch. How to Make Blue Prints. A Key Book for Every Mechanic, Builder & Draughtsman—352 pages—It's New, Comprehensive. Fully Illustrated. Gives Short Cuts, Helps, Hints, Suggestions, Questions and Answers.

**ASK TO SEE IT!**

To get this assistance for yourself, simply fill in and mail coupon today. **\$2**

**AUDEL Publishers, 49 West 23rd St., New York**  
Please mail AUDELS BLUE PRINT READING (Price \$2) if satisfactory, I will remit \$2 on its safe arrival, otherwise I will return the book.

Name.....  
Address.....  
Occupation.....  
Company.....

# MUSIC FOR FUN

**Cuts out 90% of the work in reading music!**

**YOU** can play the piano almost at sight by using the same shortcuts professionals use in reading popular music!

The **MUSIC FOR FUN** Professional method cuts out 90% of the effort and mystery—makes your music sound better, too. If you play now, you can learn these professional shortcuts quickly... or if you have never hit a piano key, you'll still find **MUSIC FOR FUN** easy. **MONEYBACK GUARANTEE.**

Of course if you want to be a Paderewski, you should stick to the old-fashioned methods. But if you want to have real fun with your piano, if you want to read popular music quickly and easily, send for the first four **MUSIC FOR FUN** lessons today—only \$1 C.O.D. plus postal charges.

**Chuck Dutton, MUSIC for FUN**  
1116 Estancia, Berkeley 6, Calif.

**FIRST FOUR \$1 LESSONS**  
C. O. D. plus postal charges

# STUDY AT HOME

**With A Chartered Educational Institution**

Courses in **ENGINEERING**: Electrical, Civil, Mechanical, Drafting, Architectural, Steam, Aeronautical, Radio, Structural, Mining, Industrial, Highway, Petroleum, Marine, Chemical.

Courses in **ARTS AND SCIENCES**: Philosophy, Education, Letters, Public Health, Medical Jurisprudence, Psychology, Sociology, Physics, Chemistry, Geology, Botany, Zoology, Law, Business and Commerce, Accounting, Mathematics, Statistics, Agriculture.

McIntyre-Rosenblatt Incorporated, 4410-AE, Sheridan Road, Chicago, 40

# PLASTICS

Learn the practical way School founded in 1910. Write for booklet, PS. Affiliated schools in principal Eastern cities.

**NEW YORK TECH. SCHOOL** 308 8TH AVE. NEW YORK 13, N. Y.

**Correspondence Courses in** **RADIO and ELECTRICAL ENGINEERING** **LOW AS \$25**

**ELECTRICAL ENGINEERING** Get good grasp of wide electrical field. Modern, very understandable. Theory made easy.

**RADIO ENGINEERING** Extra fine course in radio, public address, photo-electric work. Training you in to be super service man, real vacuum tube technician. Tuition ONLY \$25. Other course. Deferred payment plan. Survtimes needed badly.

**FREE** Write for free copies of school catalogs, student magazines etc. **LINCOLN ENGINEERING SCHOOL, Frankfort 15, Box 1582** (Formerly at Lincoln, Neb.) **WASHINGTON, D. C.**

# ARMY-NAVY BARGAINS

Gun sling .... \$ .50	Cart belt .. \$ .60
Hobbles ..... .50	Rope lariat .... .75
Leather belt ..... .75	Hessian b'net ..... 1.00
Short shovel . . . .85	10 Gun Flints ..... 1.00

75th Anniversary Catalog 1865-1940 308 pages. over 2,000 illustrations of pistols, rifles, daggers, medals, saddles, etc. mailed for 50c. 1943 circular for 3c stamp.

**FRANCIS BANNERMAN SONS, 501 Broadway, N. Y. (12)**

# EARN MONEY PAINTING PORTRAITS

• No previous training or talent necessary. Unique Stuart System teaches you, by mail in 11 simple easy-to-follow lessons, to make excellent charcoal and oil likenesses. Detailed guidance for your every step. Send for free book today.

**STUART STUDIOS**  
121 Monument Circle, Room 202, Indianapolis 6, Ind.

Please send me free book and outline of lessons.

Name.....  
Street.....  
City.....State.....



## Add a Language To Your Assets by LINGUAPHONE

★ In War, in Peace, ability to speak another language is an asset which will tip the scales in your favor... open new opportunities, earn promotion.

*Speak* { ITALIAN POLISH  
SPANISH NORWEGIAN  
PORTUGUESE FRENCH  
RUSSIAN GERMAN  
JAPANESE  
or any of 20 other languages

Quickly, easily, correctly by  
**LINGUAPHONE Ear-Eye METHOD**

This amazingly simple and delightful way to learn to speak any of 29 languages in your own home is the work of 130 of the foremost language teachers of famous universities.

You merely LISTEN to the voice of native teachers. Your EYES follow the text and illustrations... and before you are aware you are repeating the questions and answers as naturally as speaking with a native.

Endorsed by educational authorities, Linguaphone is used by Army, Navy, Flying, Signal, Medical Corps and other services; by 14,000 schools, colleges and by more than one million home-study students. Do not confuse Linguaphone Ear-Eye Method with any other.

Send for FREE book. Call for FREE Demonstration.

**LINGUAPHONE INSTITUTE**

58 RCA Bldg. • New York (20), N. Y. • CI 7-0830

## LEARN MONEY-MAKING CARTOONING

Have a simple method that has helped train creators of "Terry & Friends," "Washburn," "Out Our Way," "Winnie Winkle," "The Yellows," "Nutmeg," "As It Seems," "Secret Agent X-7," and many others. Learn while learning. Rush for free picture chart, list of your own, and full details. (State name)

THE LONDON SCHOOL, 6422 National Building, Philadelphia, Pa.

## RAISE GUINEA PIGS



MAKE MONEY. Thousands needed—War demand great. We supply breeders and buy the young. Write today for FREE illustrated booklet. **RESEARCH SUPPLY CO.**, Dept. D-7, 2436 W. York St., Phila. 32, Pa.

## Short-Cut Mathematics COMBINED WITH Practical Mechanics Simplified

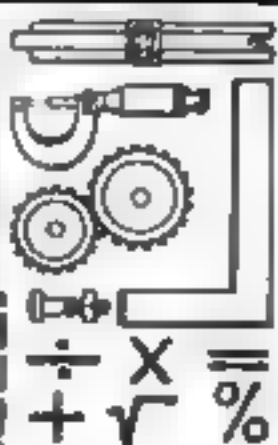
NEW 3-in-1 reading course! Now you can learn the speedy, simplified system of calculation used by draftsmen, engineers, accountants, master blinds on the stage. Learn easy way to multiply & figures by 6 figures without using old-fashioned multiplication; add long columns of figures this lightning short-cut method. Learn horsepower, slide rule, micrometer, logarithms, wood measure, puzzles, etc. etc. Large illustrated volume complete with answers. Only \$1.00 postpaid. Satisfaction or refund. Amaze friends with your magic-like mental powers.

**FREE** Complete details, mail coupon TODAY!

RESEND CO., 321 S. Wabash, Dept. E-304, Chicago. Please send free details about "Short-Cut Mathematics and Practical Mechanics Simplified." No obligation.

Name \_\_\_\_\_

Address \_\_\_\_\_



## MEN AND WOMEN!

Has your war work given you  
an idea for a patentable

## INVENTION?



An "invention" doesn't necessarily have to be a complicated, technical mass of machinery... Most inventions are the outgrowth of an idea that someone had to do something better, faster or cheaper. It's possible that you've figured out a gadget... or an improvement on a machine... that will help someone do it easier, faster, cheaper."



MAYBE YOU CAN?

## CASH IN ON IT!!

The only difference between you and a successful, money-making inventor may be that he went ahead and DID SOMETHING ABOUT IT! Most professional inventors turn their inventions over to a reliable Registered Patent Attorney whose trained staff is equipped to secure a strong patent for the inventor with the greatest possible speed and at a minimum of expense. When you hold a patent you have the right to exclude others from making, using or selling your invention for a period of 17 years... which means that no one can cash in on your invention without your permission, no manufacturer can make money on it without buying your patent or paying you a satisfactory royalty unless he wishes to risk a suit in court. Furthermore, most manufacturers refuse to consider an invention for commercialization unless the inventor has first filed for his patent. Don't let the fact that it may be a simple invention bother you... remember the paper clip, nothing but a twisted wire... but today it is an almost indispensable piece of office equipment.

NEARLY A HALF-CENTURY of  
Patent Experience—At your Service!

NOW is the time to use your initiative! Your first step, which costs you nothing and doesn't obligate you is to write TODAY... right now... for our two big books, 84 pages of facts and information, which tell just how to go about getting a patent; how to market it; what kind of sketch or model is needed, how to make a proper disclosure; 113 mechanical movements; etc. Do you want to cash in on your invention? It's UP TO YOU!



VICTOR J.  
**EVANS & Co.**

*Merlin M. Evans*

REGISTERED PATENT ATTORNEYS

MAIN OFFICE: 840-B MERLIN BLDG.  
WASHINGTON 6, D. C.

Please send me your books, "Patent Protection" and "How to Sell an Invention" without cost or obligation:

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY AND STATE \_\_\_\_\_



Listen  
to this  
Record!



# SPEAK SPANISH

FRENCH, GERMAN, OR ITALIAN

Big opportunities awaiting Americans who speak Spanish. Learn as a child learns—by listening to these brand new CORTINA recordings.

**Only 15 Minutes a Day**



Cortinaphone Method famous for 60 years. THOUSANDS have found it the most fascinating, most satisfactory method. Here is the quick, easy way to learn Spanish for PLEASURE AND BUSINESS. INVESTIGATE!

**Sent on 5 Days Approval**

'The Cortinaphone Short-Cut'—tells just what you want to know. Interesting. Get it!

**Write Today—NOW**

CORTINA Academy (Language Specialists for 60 Yrs.)  
Suite 452, 105 W. 40th St., New York 18, N. Y.

Please send me—without obligation—your free booklet. I am interested in (mark)

☐ SPANISH ☐ French ☐ Italian ☐ German

Name .....

Address .....

**Be Popular—Learn  
the Newest DANCES  
in 5 DAYS—or NO COST!**

**NEW REVISED EDITION  
of DANCING**

Includes the Rumba, Congo,  
Samba, Jitterbug . . . Fox  
Trot, Waltz and Top Dancing.

All the newest Swing steps—  
the Rumba, Congo, Samba,  
Jitterbug as well as the  
Fox Trot, Waltz and basic  
top steps explained with  
simple, graphic diagrams.

**GET MORE FUN OUT OF  
LIFE!** Swing your way to  
popularity! Start now and  
all your future with no  
money! **MAKE THIS FREE  
TEST!** The new REVISED  
edition of Betty Lee's book  
Dancing helps you learn  
correctly and quickly. Be convinced. If not satisfied with results,  
you will get your money back! And remember, we include two other  
books: "Top Tapping" and "Swing Steps"—FREE of extra charge.

**SEND NO MONEY!** Pay the postman 5¢. OR plus a few cents postage.  
Follow instructions in ALL THREE BOOKS practice simple dance  
steps each day and in 5 days if you haven't learned to dance,  
we will refund your money!



PIONEER PUBLICATIONS, INC.  
1790 Broadway, Dept. 872H  
New York 19, N. Y.

Send me "Dancing" by Betty Lee, and  
include 3 free books.

☐ Ship C.O.D. I will pay on arrival.

☐ I enclose \$1.98. Ship postage prepaid.

If in 5 days I do not learn to dance, I may  
return book and you will refund purchase price.

Name .....

Address .....

City .....

State .....

# Can't Keep Grandma In Her Chair

She's as Lively as a Youngster—  
Now her Backache is better

Many sufferers relieve nagging backache quickly, once they discover that the real cause of their trouble may be tired kidneys.

The kidneys are Nature's chief way of taking the excess acids and waste out of the blood. They help most people pass about 8 pints a day.

When disorder of kidney function permits poisonous matter to remain in your blood, it may cause nagging backache, rheumatic pains, leg pains, loss of pep and energy, getting up nights, swelling, puffiness under the eyes, headaches and dizziness.

Don't wait! Ask your druggist for Doan's Pills, used successfully by millions for over 40 years. They give happy relief and will help the 15 miles of kidney tubes flush out poisonous waste from your blood. Get Doan's Pills.

Learn to **MOUNT BIRDS**

**Tan SKINS, make up FURS**

Be a Taxidermist. Double your hunting fun. We teach you at Home. Mount Birds, Animals, Fish, Mammals, mounted specimens. Fun and profits. Decorate homes and **MAKE MONEY** Mount, game, tan for others. Big profits in spare time. **WRITE TODAY.** 100 game pictures in **FREE BOOK** Hunters get your copy. It's Now Free. Send post card. State your AGE, **NORTHWESTERN SCHOOL OF TAXIDERMY** Dept. 3202 Omaha, Nebraska

# STAMMER?

This new 128 page book, *Stammering: Its Cause and Correction*, describes the Logan's Method for scientific correction of stammering and stuttering. **WRITE TODAY** for 42 years. Earl M. Bogue, Dept. 1058, Circle Tower, Indianapolis 4, Ind.



# ARTISTS MAKE MONEY

Find out your ability. Send name, age, occupation and address for Free Vocational Art Test.

ART INSTRUCTION, INC., 2144 Art Instruction Bldg., Minneapolis, Minn.  
(Formerly Federal Schools, Inc.)

Learn  
**PHOTOGRAPHY**  
at Home

Splendid opportunities. Prepare in spare time. Easy plan. No previous experience needed, common school education sufficient. Send for free booklet "Opportunities in Photography" particulars and requirements.

**American School of Photography**  
1318 Michigan Ave., Dept. 1362 Chicago, Ill.

Learn **MECHANICAL DENTISTRY**

A profession offering unlimited opportunities. Most modern and complete course embracing every branch from Plating to Porcelain Work which prepares you to work for Dentists or start your own business. Individual instruction practical training in day or night school. No books—no classes. Catalog upon request.

**MCCARRIE SCHOOL OF MECHANICAL DENTISTRY**  
207 N. Broad St. Dept. 823 Philadelphia, Pa.

# TWO FINE PIECES OF U. S. NAVY JEWELRY

Grand "Sweetheart" Combination Gift!

...the pin for HER... the ring for HIM

No. 3121 Men's heavy ring in 14K

Solid Gold, only \$16.98. In 5K and

Silver \$7.99. Lady's pin (No.

in gold sterling, 14K gold and

anchor \$1.98. Pictures sizes

and Prices include postage and

10% Federal Tax. Satisfaction

guaranteed. Send for free cir-

cular of Navy jewelry.



HERFF-JONES-CHICAGO, Inc., Dept. PS, 32 W. Randolph, Chicago 2, Ill.



# FIX ANY RADIO

## Amazing New Invention



### FOR BEGINNERS OR EXPERTS

Learn quickly to repair all radio sets. New revolutionary different comparison picture method simplifies radio servicing. No previous radio knowledge required. Introductory training included. Find any fault with ease. Do expert radio work almost immediately. Repair radios in minutes instead of hours. Pat. U. S. Copyrighted. Take advantage of this new invention.

### NO EQUIPMENT NEEDED

You can fix any radio using a screw driver, pliers, and a piece of wire. No testers needed. Simple point-to-point picture suggests one test you want to look for defects. How to test radio circuits and parts, and how to make the repair. You may try the plan for 10 days without any risk. Send coupon.

### RADIO MADE EASY

Let this plan with its easy-to-understand diagrams, simplified ultra-ones, hints, job-sheets, and practical examples, teach you basic radio facts. Learn important short-cuts in radio trouble shooting. Make needed tests without testers. Trace the signal measure voltage within the hour after receiving the plan. Follow the comparison tests given in 14 large trouble-shooting blueprints. Over 1,000 repair hints. Data on all tubes. Covers every radio set, new and old.

PRICE  
**\$1.50**  
COMPLETE

### 10 DAYS "NO RISK" TRIAL

Examine and use **Simplified Radio Servicing** plan for 10 days in your own home. Apply this information to repair one of more radios. Then decide to keep this greatest radio (radio) bargain, or return the manual and get your money refunded in full. You take no risk. Satisfaction guaranteed or your money back.

Price, only \$1.50, post-paid. In large Manual form, 8 1/2 x 11 in. 16 trouble-shooting blueprints. Includes over 340 radio tubes. 112 large, fact-packed pages. Over 1,000 time-saving hints. Developed by M. N. Belman, Engineer, teacher, and author. Order without risk. See 10 days.

### REPAIR RADIOS IN MINUTES

Read the introductory job sheets. Follow the step-by-step picture blueprints and fix any radio in a matter of minutes. The radio work is fun and profit. The complete manual and training is yours for only \$1.50 post-paid. 10 days' trial. Money back guarantee.

### MORE HELP—IF NEEDED

Supplement your study, clear up difficult problems, get ahead in Radio. A complete 310 page manual, **PRACTICAL RADIO**, will give you needed extra help. You get ahead faster, present important facts in greater detail. For order this new manual also, a year's trial order. See coupon. Order both manuals.

## TRIAL ORDER COUPON

SUPREME PUBLICATIONS, 328 S. Jefferson St., Chicago 6, ILL.

Ship the following manuals to me for 10 days' trial under your money back guarantee.

**Simplified Radio Servicing @ \$1.50** 1 **Practical Radio @ \$2.95**  
(Complete Servicing Manual) (Supplementary Manual)

☐ I am enclosing \$ full price. You pay postage.

☐ Send C. O. D. I am enclosing a deposit of \$

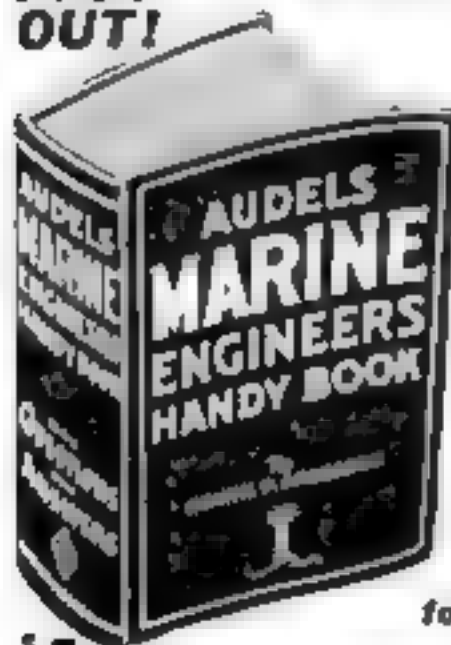
Name \_\_\_\_\_

P.S.

Address \_\_\_\_\_

## EVERY MARINE ENGINEER CAN USE THIS BOOK

**JUST OUT!** New From Cover To Cover AUDELS



### MARINE ENGINEERS Handy Book

Entirely modern, Practical Treatise for Marine Engineers (all grades), Firemen, Oilers, Machinists and Students with Calculations and Questions and Answers for Examinations.

**LATE INFORMATION** in a Handy Form covering all branches of modern Marine Engineering with step-by-step solutions on hundreds of problems. —Tables and Data—Fully Indexed. Easy to Understand—Size 6 1/2 x 6 x 1 1/4.

**Indispensable for Upgrading Examinations and Ready Reference.**

**4 COMPLETE** 1280 PAGES—FULLY ILLUSTRATED  
ASK TO SEE IT—Get this information for yourself—

ONLY 1 NO. Clip this coupon and mail today!

AUDELS, Publishers, 40 W. 23 St., New York 10, N.Y.

Mail AUDELS MARINE ENGINEERS Handy Book (Price \$4) on 7 days free trial. If O. K., I will remit \$1 in 7 days and \$1 monthly until \$4 is paid. Otherwise, I will return it.

Name \_\_\_\_\_

Address \_\_\_\_\_

Occupation \_\_\_\_\_

Employed by \_\_\_\_\_ P.S.M.

## MUSICIANS.. Here's the Answer!

HOW TO MAKE YOUR INSTRUMENT LAST FOR THE DURATION



ADD YEARS to the life of your band instrument! It must last for the duration... That's why you need this new and helpful book, "How To Care For Your Instrument." In no other book can you find such valuable and helpful information. Covers all makes and types—wind and percussion. 40 pages of instructions, 46 illustrations, to help you make your instrument last longer. Worth many times its 10c cost. Get one at your Conn dealer's store or send 10c to us.

C. G. CONN, Ltd. 232 Conn Bldg., Elmhurst, Ind.  
Send me \_\_\_\_\_ copies of "How To Care For Your Instrument." Enclosed is 10c in coin or stamps for each copy.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_



# Learn this Profitable Profession



**IN 90 DAYS  
AT HOME**

## Money-Making Career Open to Men and Women, 18 to 50

Hundreds of men and women between 18 and 50 make \$15 to \$20 in a single day giving scientific Swedish Massage and Hydro-Therapy treatments. There is big demand from doctors, hospitals, sanitariums and clubs. Graduates earn large full time incomes from these or in private practice in their own offices. Others make good money from home treatments given in spare time. Learn this interesting money-making profession in your own home through our home study course. Home instructors as in our nationally known resident school. You can win independence and prepare for future security by qualifying for your Diploma. Course can be completed in 3 to 4 months. Many earn while they learn. Begin your training at once.



### Anatomy Charts & Booklet FREE

Enroll now and we will include, at no extra cost, many needed supplies. Fit yourself to help meet growing demand for massage now and after the war. Send the coupon at once for complete details, Anatomy Charts and 32-Page Illustrated Booklet, FREE, postpaid.

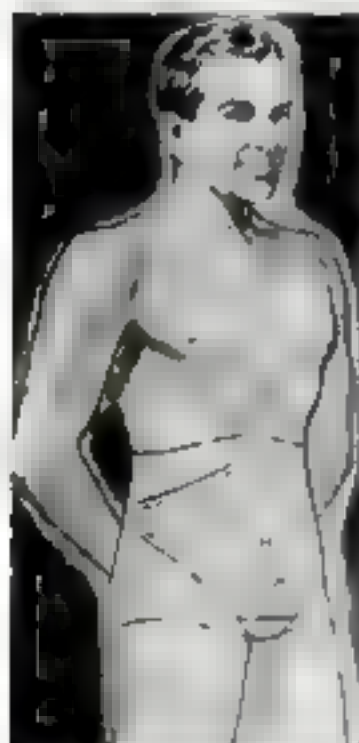
**THE COLLEGE OF SWEDISH MASSAGE**  
Dept. 279, 100 East Ohio St., Chicago 11, Illinois

Please send me FREE and postpaid, Anatomy Charts, 32-page Booklet and complete details on Home Training.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_



**THOUSANDS of MEN  
NOW  
Appear Feel Look  
SLIMMER BETTER YOUNGER  
with Commander**

Commander Supporter  
The Sensational NEW PRINCIPLE  
of Abdominal Support

Keep your hands over the abdomen as in the picture. This simple, easy, and effective method will give you a firm, flat, and healthy abdomen. It will also give you a better posture and a more youthful appearance. The Commander Supporter is the only device that will give you all these benefits. It is made of soft, comfortable material and is easy to wear. It is also very effective in relieving back pain and other abdominal ailments. Try it today and you will see the difference it makes.

**TRY IT TEN DAYS  
At Our Expense**

Do this today. Send for the Commander Supporter. If you are not satisfied, we will refund your money. No questions asked. This is our guarantee.

**\$2.95**



**10 DAY FREE TRIAL COUPON—MAIL TODAY**

Ward Green Company, Dept. A-912  
342 Madison Ave. New York 17, N. Y.  
Send me The Commander Supporter for Free Trial. I will pay nothing. If I am not satisfied, I will return it for a prompt refund. (Size 40 to 48 \$2.95.)

My waist measure \_\_\_\_\_

My height \_\_\_\_\_

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

We pay postage if \$2.95 is included



**Wow Them with  
TRICKS!  
Learn in 5 Minutes!**

Baffling Card Tricks, Streamingly  
Funny Practical Jokes—Complete  
with Apparatus and Instructions!

## GIANT OUTFIT Only \$1

Myrtify your friends and fellow workers—read their minds—make cards disappear BY MAGIC! Be the life of every party with easily-learned tricks that startle, puzzle, amaze, and leave your friends breathless with surprise! Get this thrilling BAG-O-TRIX & PUZZLES that will skyrocket you to popularity. Do the "impossible" right before their eyes! BAG-O-TRIX & PUZZLES contains full apparatus, 28 Different Articles and Gadgets for Baffling Card Tricks, daring practical jokes—things you can easily learn to do like a professional performer in 5 minutes. Take this short cut to instant popularity.



### FREE JOKE BOOK

Pages and pages of laughs. Funny stories, epigrams, you'll enjoy reading and telling. Includes absolutely FREE if you order BAG-O-TRIX & PUZZLES promptly! Hurry!

Fun to learn—more fun to do. Guarantees hours of laughs for everyone—young and old, men and women. Service men will like it too. Simple complete instructions included.

### Send No Money!

Just send your name and address on postcard. Pay postman only \$1.00 plus few cents postage when BAG-O-TRIX & PUZZLES reaches you. EXTRA—big Joke Book included FREE if you order NOW. Keep 5 days. If not delighted, return BAG-O-TRIX & PUZZLES for full refund. We pay postage if \$1.00 is sent with order. Same guarantee. Be the magician in your crowd. Act now!

TRIX CO., 52 W. Washington St., Dept. D 50, Chicago 2, ILL.

## Inventions Wanted Patented or Unpatented

Inventions can now be safely sold without patenting expense. If you have a practical, useful idea for sale (either unpatented or patented) write today!

### Chartered Institute of American Inventors

Dept. S, 631 Pa. Ave. N. W., Washington, D. C.



# PATENTS

## AND TRADE MARKS

### C. A. SNOW & CO.

Registered Patent Attorneys Since 1875

Write for Free Book and "Certification of Invention" form

427 SNOW BUILDING, WASHINGTON 1, D. C.



## PATENTS PERSONAL SERVICE

My Personal Service assures strictest confidence on all your patent problems. Send me a model or drawing, or sketch and description of your invention, and \$5.00. I will make a search and report promptly as to its patentability and send you a copy of my 12 page booklet. Or, if you prefer to read my booklet first, write today for FREE copy. Registered Patent Attorney.

L. F. Randolph, 340-D Columbian Bldg., Washington, D.C.

## PATENT YOUR IDEAS

SEND FOR FREE BOOK

Written by Former Member Examining Corps (1922-24) U. S. Patent Office.

**CARL MILLER, Registered Patent Attorney**  
Former Member Examining Corps U. S. Patent Office

Windsor Bldg., Dept. 24-C, New York—Good Bldg., Dept. 24-C, Washington, D. C.

## How to Obtain a PATENT



**Classified Ads only 35c per word per insertion, payable in advance. Minimum ad 10 words. To be included in March issue copy should be in our office by January 8th. March issue on sale February 1st.**  
**POPULAR SCIENCE MONTHLY—351 FOURTH AVE.—NEW YORK CITY 10**

## ADVERTISING

**ADVERTISING** placed—any publication—lowest rates—complete agency service. Skilled advertising merchandising counsel. Rate list and booklet entitled "Advertising Results For Sale" free. Baker Agency, 1302 West Dodge, Omaha, Nebraska.

**MAIL** Order or agent ad reaching 1,000,000 families throughout United States \$13.40 inch. Newspaper, magazine mailing list, ratebook, free. Chicago Advertising Agency, 20 85 West Jackson, Chicago.

**CARTOONS** for your Advertising. Quality work and Prompt Service. Write for estimate on your job. Henry Littlejohn, Box 72, Greenville, South Carolina.

**ADVERTISE** 34 words, 149 newspapers, \$8.50. List Free. Advertising Bureau, 4616-P Cottage Grove, Chicago 18.

**24 WORDS** 10 newspapers \$2.00. Goodale 37 Gardner, Van Nuys, California.

## AGENTS WANTED

**START** Your Own Business on our capital. Always your own boss. Hundreds average \$2,000 to \$5,000 annual income year after year. We supply stocks, equipment on credit. 700 home necessities. Being experienced unnecessary to start. Wonderful opportunity to own pleasant profitable business backed by world wide delivery. Write Raleigh Co., Dept. B U-P&C, Freeport, Ill.

**SCHOOL** Seniors—Sell America's most beautiful distinctive Graduation Name Cards. Positively highest commission. Lowest prices. Free sample kit. Printcraft, 1423 East Elm Street, Scranton, Pa.

**AMBITIOUS** School Seniors—Sell Classmates the "tops" in graduation name cards, Best commissions. Free cards. Agencies going like wildfire. Hurry! Craftcards, Box 236-M, Pittsburgh 30, Pennsylvania.

**GOOD** Paying Business Silvering mirrors, plating autopaets, reflectors, bicycles, bathroom fixtures, etc., by late method. No tanks or shop required, outfit furnished. Free Booklet, Gunmetal Co., Ave. G, Decatur, Illinois.

**EXCELLENT** Side-line for Printing Salesmen. Decalcomania Name Plates in small quantities. Also, make money applying initials on Automobiles. Free Samples. "Raleco", 1463 Washington, Boston (18).

**CALL** on friends with Greeting Card Assortments. Easter Birthday other occasions. Personal Stationery Gift Wrappings. Big profits. Experience unnecessary. Samples on approval. Wallace Brown, 225 Fifth Avenue Dept. E-4, New York.

**WRITE** for big package actual sample fabrics and styles. Absolutely Free. Dresses, lingerie, hostery shirts etc. Take orders. Commissions big. Send no money. Write for your Free line today. Melville Company, Dept. 1807 Cincinnati Ohio.

**TAKE** orders for new, sensational Plastic Lifetime Reproductions of any photo or negative. Amazingly beautiful. Big earning opportunity. Part or full time. Get data quickly. Quaker Service Co., 914 Walnut St., Philadelphia, Pa.

**SELL** 50 for \$1.00 name imprinted stationery—free samples. Odd cards 2 pc. Fast selling line. Everyday Greeting Card assortments 35c up. Cards for Boys and Girls in service. Special offer. New England Art Publishers, North Abington, Mass.

**AGENTS**—Coin Money. It's New. It's Hot! Everyone wants radiant plastic plaques of loved ones. Commissions advanced. We deliver collect. Sample 7 x 9 prepaid \$1. London Box 137 Upper Darby Pa.

**BIG** Money taking orders: shirts, ties, socks, pants, jackets, sweaters, shoes, uniforms, etc. Sales Equipment Free. Experience unnecessary. Nimrod, 4922-AV Lincoln, Chicago.

**SELL** Dresses at Low Prices. Hundreds sensational bargains. Actual samples free. Send dress size age. Hartford Dept. A 361 Cincinnati Ohio.

**LUMINOUS** Paint, (Shines in Dark). Profitable seller to thousands of homes, stores, offices, and factories. Details. Ward 97B Saybrook, Connecticut.

**AGENTS**—300% Profit selling Gold Leaf Window Letters, stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

**LICK** After-war layoff! Start own business! Home, office. Booklets describing "Collection of 127 Tested Plans" free. Kite Co., 314A Grand St., New York.

**FREE** Water and our concentrates, makes flavors, lotions, shampoos, 72 products, labels, bottles furnished. Quelco, P-20030 Russell, Detroit.

**STRANGE** "Dry" Window Cleaner, Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kestee 132 Akron Ohio.

**WANTED** Agents—Simple device to apply strap emergency skid chains. Send 25c for sample. Muser Co., 2917 Jefferson Dr., Toledo 4, Ohio.

**POWERFUL** Mile Stretcher! Increases mileage—power, 400% Profit! Guaranteed. Thermopower Peoria 4 Illinois.

**GREETING** Card Assortments. Everyday and Birthday, 4164 Fifth St., Philadelphia 40.

**SELL** up to date tax records now. Business booming. ABC Records Co., Minneapolis, Minnesota.

**PLAYING** card game, 350% profit. Sample game 25c. Box 842 Denver 1 Colorado.

**100% PROFIT**, Sample 5c. Anderson, 119 West Fifth, Topeka, Kansas.

## ANTIQUES, RELICS INDIAN GOODS

**345** ANTIQUE Firearms, Swords, Rifles, Cartridges, Indian Relics. Catalog 10c (Photographs of Most). Heike, Wemona, Illinois.

**4000** BARGAINS, Indian relics, Antiques, Guns, Minerals, Coins, Fossils. Catalog 10c. (Photographs of Most). Museum, Wemona, Ill.

**SWORDS**, rapiers, daggers, pistols, armor; illustrated catalog, 25c. Robert Abels, 260 1/2 Lexington Ave., N Y.

**25** GENUINE Indian Arrow heads, \$1.00. Catalog. Geo. Bolder, Glenwood, Ark.

## ARCH SUPPORTS

**BIG** Profits Make and fit arch supports. Particulars, Julia Corssen, 3408 Texas, St. Louis 14, Mo.

## ATHLETE SERVICE

**VETERAN** professional writer will coach beginners. Information on request. Philip, 5344 Newport, Chicago.

## AUTOMOBILES

**SAVE** Gasoline and your Motor Improved. Ozone Hyperube. The Synchronistic Hyperlubric Motor Fortifying Super Fuel Engine. Send One Dollar for 900 Miles of Ozone Hyperube Motor Maintenance. Agents wanted. Money Back Guarantee. Hyperube Co., Box 46, Long Island City, New York.

**WHIRLOAS** Turbinator 41 brings remarkably efficient economical motor performance by cyclonic vaporization of carburetor mixture. Users report savings high as 40%. Wrench inside 15 minutes. Oily auto make year. John Hanley, 5718 Lorraine, Detroit 8, Michigan.

**SAVE** Gas—With Mo-o-Purr—new scientific laboratory-tested tablet. Users report saving gas up to 40%. Results guaranteed. \$1.00 package treats 140 gallons. Liberal supply 25c. Free literature. Mo-o-Purr Distributors, Ames Station, Omaha, Nebraska.

**AUTOMOBILE** Racing Book Fifth Edition. Revised. Tells how to build dirt track bodies, frames, engines. Records superchargers, rules, formula plans, stock conversions, roadster racing. Fast Ford \$1.00 postpaid. \$1.50 C.O.D. Ray Kuna Department 774, Madisonville Cincinnati Ohio.

**THIS** Victory Gasoline Economizer will increase your mileage on any car to 31% or better. Send 25c coins for complete detailed instructions diagrams. Modern Advancement, P.O. Box 674, New York 1, N Y.

**INEXPENSIVE** automobile formulas, 120 octane fuel—automobile fuel—wood, coal gas (Not gasoline). Fifty cents. William Kemp, Dover Ohio.

**1944** IGNITION Supercharger. Fast Starting. Mileage. Pep. \$3.50. EO Sales Mfg. Co., 40 John Street, New York.

**RENEW** car batteries inexpensively. Instructions \$.00. Popular Service, Racine, Wisconsin.

## AUTO SUPPLIES & EQUIPMENT

**CLYMER** Chromed Spotlight for Automobiles. Motorcycles. Boats. Hunters. Trigger switch pistol grip. Very powerful off any 4-8 battery. Reduced to \$5.00 postpaid. Clymerite Best Aluminum Pistons. V-8 or Model A \$2.00 each. California combination set Dual Mufflers, V-8 and Mercury saves gasoline, beautiful deep tone, \$20.00 complete. Clymer, 3125 W Pico, Los Angeles 5, California.

**DIESEL** conversions for auto, tractor, and Marine engines. Cheap installation. Wonderful performance. Proven factory method. Different and better. Costs nothing to investigate. Write for free circular. No 1 Harrington Company 201-204 Manchester Bldg., Portland, Oregon.







**MAKE Money at home in spare time by mail** Write Gordon Publishers, Box 23 Pawtucket, R. I.

**SIDELINE Business**—Mail our Literature—Stamp brings details! Dalton, Box 3363, Seattle, Washington.

**RAISE** Angora Rabbits—Wool brings \$8.00 pound. Particulars free. Grinstead's, Edwardsville, Illinois.

**SPARETIME** mail setup, samples 10c. Merchandisers, 1026 Gunderson, Oak Park, Ill.

**500+ PROFIT** puncture proofing tires! Details for stamp Betke, Box 499, Boxer, Texas.

**PROFITABLE** business for you. Information free, Rely 14548 Superior, Cleveland 18, Ohio.

**MAIL** and distribute circulars wonderful opportunity. Miracle Factories, Omschocken, Pa.

**UNHEARD** of opportunity to enter "Big Time" mail order business. June, 101-8 Beech Holyoke, Mass.

**127 MONEY** making opportunities local and mail order. Investigate. Elite Co 314A Grand St., New York.

**MONEY** Making at home office free information. McDaniel, 939 East Euclid, Detroit 11, Michigan.

**OPPORTUNITIES**, Many, Magazine 10c. Name listed 10c. Benick, Holland New York.

**13-INSTRUCTIVE** Art Books, Literature Free. Hoffmann, 3740 Gay, Cincinnati 19, Ohio.

**BIG** Money in Mail Order; details for stamp. Sawyer, 732C, Gainesville, Florida.

**MAIL** Sales Engineering helps you succeed. Seriously ambitious people write! A. Hanes, 210P Fifth Ave. New York 6 N.Y.

**GET** Dollars by Mail! 90c profit. Instructions 10c. Terrill Hogard 1 Mo.

#### BUSINESS SERVICE

**REPRESENTATION** in Washington, D. C. Write Service Bureau, 1401-25th St., S. E.

#### CAMERAS, PHOTO SUPPLIES

**FILTERS**, Sunshades, Filter Holders—1 n. ed apps. At any camera. Made of pre-war aluminum. Filters of solid optical glass. Filters available in every color. Impossible to obtain after present supply is exhausted for the duration. Send only \$1.00 per item and lens diameter, shipped postpaid return mail. To allow equitable distribution we can allow but one of each item to a customer. Satisfaction guaranteed. V. X. Company, 1828 Central Avenue, Indianapolis 2, Indiana.

**WE** Pay Top Prices for used cameras and photographic equipment. Turn your idle camera enlarger printer, lenses, developing equipment etc. into cash. Just send us a list of what you have. State make, model, age, condition. We will write you at once, telling you what we'll pay. Prepare your list today. Send to Central Camera Co. (Photographic Headquarters since 1898), 230 S. Wabash Ave., Dept. A-182, Chicago, Illinois.

**AMATEUR** Photographers attention! Improve your hobby of picture taking and learn how to make money with it. Write today for our 40-page book catalog and a sample copy of American Photography enclosing ten cents for postage. Contains articles and pictures of the world's foremost writers and pictorialists. Camera House 141, 161 Newbury St. Boston, Mass.

**WE** pay peak prices for cameras, lenses, movie cameras, movie projectors, movie lenses binoculars. Sell now! Write giving full particulars condition or send in via railway express collect for free estimate or C.O.D. with inspection privilege. If no purchase your property will be returned to you prepaid, insured. Aramac Camera Co. Dept. B, 1 E 43rd St., New York 17, N. Y.

**BASS** Says War time proves Bass leadership. Amazing selection of finest still cameras—Leica, Contax, Kore's Reflex. Argus new and used still available. Write for quotations. Satisfaction guaranteed or your money refunded. Bass buys 'em, sells 'em, trades 'em. Bass Camera Company, Dept. 8P, 178 W. Madison St., Chicago, Ill.

## POPULAR SCIENCE Opportunities

**CASH!** Spot cash for cameras, lenses, binoculars, movie or still, sound projectors. Send full description by mail, or wire for prompt cash offer. Over 30 years of dependability insures honorable dealings. Bass Camera Company 178 West Madison Street, Chicago, Illinois.

**OIL** coloring photographs a fascinating hobby or profitable business. Learn at home. Easy simplified method. Previous experience unnecessary. Send for free information and requirements. National Art School, 1315 Michigan, Dept. 1741, Chicago.

**AT** Last—Air and Light defying patented developers. Will not spoil when not in use. I.T. 30 soft-working, LT-17 medium-contrast. Quarts 50c. Graphic Economy Developer Co., 1434 S. Trumbull, Chicago 22, Illinois.

**MAKE** money in photography. Learn quickly at home. Easy plan. Previous experience unnecessary. Common school education sufficient. Booklet and requirements free. American School of Photography 1315 Michigan, Dept. 1741, Chicago.

### ADVERTISERS!

#### Increase Your Mail Order Business

Good advertising values are in keeping with the times.

Popular Science Monthly's **CLASSIFIED SECTION** now offers the biggest value in its history. Year after year our circulation has steadily increased. Today it is the largest it has ever been! The latest A B C report shows an average monthly circulation of

**748,593**

This is a substantial increase in the number of prospects for classified advertisers and at no increase in advertising cost. Our classified rate is still only 35c a word.

Take advantage of this extra advertising value by offering your product or service to this great audience of Popular Science readers. Prepare your advertisement now! Count the number of words and remit at the rate of only 35c a word. Act promptly to be sure of your advertisement in the next issue.

#### Classified Section

#### POPULAR SCIENCE MONTHLY

353 Fourth Ave., New York, City

**WE** buy small cameras and lenses all sizes and types, cash or trade. Write Photo Lens Co. Inc. 140 West 32nd St., New York 1, New York.

**PRESS** Identifications for accredited news gatherers. Press Supplies, 1934-B Eleventh, Washington 1, D. C.

**PHOTOGRAPHERS**—Send quarter for new "Photo Profits" folio. Acme, Covington, Va.

#### CARTOONING, SIGN PAINTING, DRAWING AIDS

**POCKET** Cartoon Course—22 Easy Lessons in Cartooning prepared by a nationally known cartoonist with more than 20 years experience. Mailed postpaid on receipt of 25c in coin. Shack Pack Co., 12 E. Georgia St. Indianapolis 4, Ind.

**CARTOONING** Learn quickly at home. New Easy Method. Originate Comic Characters Instantly Prepared by Successful Cartoonists. Complete Course \$2.85. Details Free. National Artists P. O. Box 4248-C, Dallas 8, Texas.

#### CHALK TALK STUNTS

**CHALK** Talks, Laugh Producing Program \$1.00. Illustrated Catalog 10c. Cartoonist Balda, Oshkosh, Wisconsin.

#### CHEMICALS & APPARATUS

**CHEMISTRY** Laboratory apparatus and chemicals for industrial, analytical, and experimental laboratories. Complete supply service for students taking correspondence school chemistry courses. Send 3c postage for free 44 page catalog. Dept. M38, Biological Supply Co., 1116 Mt. Hope Ave., Rochester 7, N. Y.

**WINN'S** new idea Home Laboratory Chemical Kits and apparatus outfits for home experimenting. Send 5c for literature and retail supply catalogue. J. H. Winn Co., Dept. 611, 124 W. 23rd St., N. Y.

**HANDBOOK** for Chemical Experimenters. Hundreds of experiments, illustrated. 50c. Experiment Booklet, 15c. Chemical Catalog, 5c. Reading Scientific Co., Reading, Pa.

**100 DIFFERENT** Chemicals. One ounce each. Excellent opportunity for diversified laboratory stock. \$6.00. Midwest Chemical Co., 1724 Second Ave., South Minneapolis, Minnesota.

**LABORATORY** Supplies at Wholesale Prices. Chemistry, Biology, Physics. Catalogue, 10c. National Scientific Co., 2304 W. North Ave. Chicago. Established 1908.

**LUMINOUS** Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

**FREE** Catalog Chemistry Minerals Biology, Optics, Tracey Laboratories, Evansville, Indiana.

**LABORATORY** Spectroscope for chemical analysis \$2.50. McCutting Sons, Campbell, California.

**384 PAGE** Apparatus Catalog sent for 75c. 172 Page Chemical Catalog 25c. Laboratory Materials 7317 V. Avenue Chicago.

**FREE** chemical catalogue. Enclose 3c Postage. Greenwood, 398 Broadway, N. Y.

**FREE** Formula Catalog. Great big surprise. Western Chemical, Salem, Oregon.

#### CURIOS

**CLASS** Curios, Minerals, Indian Relics. Coins. Catalog 5c. Vernon Lemley, Las Cruces, New Mexico.

**CUHAN** novelties. Details, souvenirs 10c. International M.O. House, Colmaro, Havana, Cuba.

#### DETECTIVES

**DETECTIVE** training—Secret investigations—Easy method—Fingerprints Booklet Free. International Detective System, 1701 Monroe NE Washington 18 D. C.

**DETECTIVES**—Work home—Travel Experience unnecessary. Write, Wagner P-125 West 45th, N. Y., N. Y.

**FINGERPRINT** powder new and superior powder. William Croll, Box 803, Norristown, Pa.

**DETECTIVE** Training. Phillips Secret Service, 1917-C North Kenneth, Chicago, Illinois.

#### DOGS, BIRDS, PETS

**RABBITS** Flemish Giants, New Zealand. Reasonably priced. Franklin Young Riverhead Long Island New York.

**HEALTHY** registered Irish Setter puppies guaranteed. Earl Bond, Albert Lee, Minneapolis.

#### DRAFTING INSTRUMENTS

**FREE** catalog of drafting instruments and supplies. Gordon's, 182-D Madison, Chicago.

#### EDUCATIONAL & INSTRUCTION

**PREPARE** yourself now for a well paying radio position after the war. Obtain your FCC commercial radiotelephone and telegraph licenses through our home study courses, written for the man who has forgotten higher mathematics. An easily read, easily understood course. Moderate tuition fee. Write for particulars. American Radio Institute, 44 East 23rd Street, New York, N. Y.



**CARPENTERS** we teach the Steel Square in five easy lessons by mail. It's really fun this modern way. We are the authors of the Builders Topics Steel Square Book. You will agree that it's the best book on the Steel Sq. ever published for the beginners. Simple and non technical. Actual photographs are used and with our coaching every carpenter has a chance to better himself for the modern pre war houses to be built. Write today. Builders Topics Suite 612-13 Medical Arts Bldg. 1117 Second Avenue, Seattle 1, Washington.

**EARN** Certified Grapho-Analyst degree analyzing handwriting. Student takes earnings up to \$1.00 an hour spare time \$75.00 weekly full time. Graduates in employment credit agencies, police department, courts, business and in private practice as Personal Problem and Vocation Advisors. Fully illustrated Grapho-Analyst and 3000 word illustrated lesson free. Institute, Box 1150, Joplin, Mo.

**WHY Don't You Write?** Writing short stories, articles, etc., will enable you to earn extra money. In your spare time we teach you to write the way newspaper men learn by writing. Free "Writing Aptitude Test" tells you how you possess the fundamental qualities essential to successful writing. Write today! Newspaper Institute of America, Suite 544-B One Park Avenue, New York 16 N.Y.

**PSYCHOLOGY** teaches about mind. Bio-Psychology teaches about powers of mind over body. Use powers subconscious mind. Grow. Broaden education. Develop persons by Control emotions. Succeed. Correspondence. Dept. P Taylor School of Bio-Psychology, Chattanooga 1, Tenn.

**WELDING**—Electric Arc. Learn quickly by actual practice at Hubert Welding School. Individuals, his reaction at bare cost of materials used. 75¢ in stamps brings valuable welding lessons post paid and full particulars Hubert Welding School, Box P-242, Troy Ohio.

**"PRACTICAL Lessons In Hypnotism"** reveals latest scientific hypnotic methods. Written by Dr. Cook, noted phys., medical medicine professor. This book is a most active timely helpful 100 pages. Or \$2.00 postpaid. Mentor House, 610 Broadway New York City.

**DRAFTING** Design. Blueprint Reading. Architectural. Aeronautical. Mechanical. Electrical. Radio. Ship. Topographical. Structural. Building Estimating. Architect's Surveyors. Engineers' Licenses. Mondell Institute, 210 West 41st, New York.

**CLINICAL** Laboratory Technicians in great demand. We train you in your spare time in your own home. You can practice while studying. Write for free catalogue. Imperial Technical Institute, Box 973 B, Austin 5, Texas.

**NEW Writers** Wanted to re-write ideas in papers, magazines, books. Splendid opportunity to break into profitable writing field. Rush postcard for Free Details. Comfort Writer's Service, 210-B, South Seventh, (2), St. Louis, Mo.

**PSYCHOLOGY** of Sales "The Key" gives you power and force used by the conquerors of the world. Choose your place, name your pay. Easy, Simple, Complete \$1.00, Key to Sales, Box C Van Dyke Michigan.

**MATHEMATICS** without figuring, 500,000 problems solved by graphical method. Multiplication, division, addition, subtraction of whole numbers, fractions, and decimals. Price \$2.00, Claude Beaver 1018 S. Westlake Avenue, Los Angeles 6, California.

**PARENTS** of young children—teach them how to listen, think, remember and concentrate with a set of interesting play-exercises. Benefit last throughout life. Special only \$1.00 postpaid. Kellogg, Box 1214 B Portland 7 Oregon.

**BE A Doctor** Learn chiropractic. Fast growing profession. Residence course only. Write for catalogue. Texas Chiropractic College, San Pedro Park, San Antonio, Texas.

**RADIO** Engineering, Broadcasting Service. Electronics. Aviation. Marine & Police Radio taught thoroughly. Ad expenses low. Co-educational. Catalogue free. Dodge Institute, Dept. 100, Valparaiso, Ind.

**GOOD "Used"** educational books on all subjects bought, sold, rented, exchanged. Satisfaction guaranteed. Complete details and 34-page illustrated bargain catalogue free. Write Nelson Company, Dept. 303, Chicago.

**NIGHT** Training technique improved. Everybody gets results now. Ask for free chart and instructions. Write Dept. 82 4057 Budlong Avenue, Los Angeles 37 Calif.

**PROPHET** Club reveals prophetic forecasts. Wars and Dec '41 methods interpreted. Ronald Roosevelt on Revelations of the Christ in Here—dime, Nichols, Box 82, Warham, Mass.

**MAKE** up to \$25 \$35 week as a Trained Practical Nurse! Learn quickly at home. Booklet free. Chicago School of Nursing Dept. K 1 Chicago.

**REFRIGERATION** Service Course. 24 illustrated manuals. Easy, quick, low cost. Free booklet, Mechanics School, Dept. 8-22, 4701 West Pico, Los Angeles 6.

**EXCEPTIONAL** Opportunity. Operate a Collection Agency Credit Bureau. Quickly learned. Many make \$5,000 yearly up. Write Cole Associates, Syracuse, N.Y.

**MATHEMATICS** Arithmetic. Algebra. Geometry. Trigonometry. Calculus. Physics, Refresher. Pre induction. Mondell Institute, 210 W. 41st, New York.

**USED** Correspondence Courses, and Technical Books Bought and Rented. Catalogue Free. Educational Exchange, Heneager Alabama.

**PLASTIC** Engineering paid by Home study course. Low cost. Easy terms. Free booklet. Ohio Institute of Technology, Box P-142, Greenville, Ohio.

**FINANCIAL** Independence for salaried people. Successful plan. 50¢ write today. Harry D. Coker 436 Washington St., Denver 3, Colo.

**LOCKSMITH** Course. Lock-picking, key-cutting, etc. \$1.00 prepaid. Miller's Key Shop Canadian, Texas.

**DRAFTSMEN** in great demand. Learn easily at home. Mondell Institute, P-1 Alton 11, Ill.

**LEARN** Mental Telepathy. Surprise your friends. Teach others. Easy instructions. 25¢ Post Box 1544 C Cleveland Ohio.

**ENJOY** Health. Become professional acrobat. Free Health Book. Write Knoff 313428 North 52nd St. Milwaukee, Wis.

**SPELLING** Bee—new educational exciting card game 30¢, postpaid, catalogue 10¢. Signs Farming on Missouri.

**HOME** Study course drugless therapy. Free literature. Institute of Drugless Therapy Tama Iowa.

**LEARN** blacksmith tempering. Copyright booklet 50¢. Smith, Box 202, R. Lansing Michigan.

## ELECTRICAL SUPPLIES & EQUIP.

**EXPERIMENTORS** 1000 assorted fiber and metal washers, rivets, strips, ceramics, miscellaneous parts. Just right for the workshop \$1.95. Guaranteed satisfaction. Marko, 2924 Logan Blvd., Chicago 47 Illinois.

**ELECTRIC** Pencil. Writes—Engraves all Metals. \$1.00 postpaid. Bayer Mfg., 4515-C Cottage Grove, Chicago 15.

**FOR** Motors, Welders, Generators, Other Electrical Items. Write LeJay Mfg. 823 LeJay Building, Minneapolis, Minn.

**WIND** Electric Motors Yourself. Write. Simplex, Box 260A, Pontiac, Mich.

## ENGINES, MOTORS, ETC.

**WINDING** Data, 225 motors, single and three phase \$1.00. Motor Data, Box 7631, Kansas City 3 Mo.

**NEARLY** New White Steam Engine, Other parts, Trinkle, Ft. Morgan, Colorado.

## FARMS, OTHER REAL ESTATE.

**GOOD** Farm Bargains. Washington, Minnesota, Montana, Idaho, Oregon, North Dakota. Dependable crops, favorable climate. Write for literature. Lists describing typical farms. Specify which state. J. W. New 120 Northern Pacific Ry., St. Paul, Minn.

**SEE** the Highlands of Louisiana where winter brings no idle acres. Choice cut-over land at low prices with terms. Send for descriptive book without obligation. Long Bell Farm Land Corporation, 221 E. A. Long Bldg., Kansas City, Mo.

**STROUT'S** Big Farm Catalog! 64 Pages describing hundreds of properties in 18 states from Maine to Florida and west to the Mississippi—many pictures, rock-bottom prices. Write today for this money-making time-saving book. Free Strout Realty, 256-2B 4th Ave., New York 10, N.Y.

**BEAUTIFUL** 644 acre plantation with home-stone and quarters for eight servants—Middle Georgia—Write J. Wayne Johnson, Construction Bldg. 20, Fleet Post Office New York.

**60 ACRES**, near White River, unimproved poultry land, \$150, \$5 down, \$5 monthly. Free list and literature. Hubbard, 260 Groesman Bldg., Kansas City, Kans.

**MINNESOTA**, Wisconsin Lake frontage \$7 acre! 2003-C Rutherford, Hollywood 28, Calif.

**FLORIDA** Lands on Easy payments. R. W. Stewart, Inverness, Florida.

## FIND GLASSES, TELESCOPES, ETC.

**MICROSCOPES**, Telescopes, Binoculars, all scientific, chemical, laboratory apparatus—bought, exchanged. Exclusively our business for fifteen years. Not get-rich-quick speculators. True, will show that we know apparatus, highest prices paid. Harry Rice 64 W Broadway N.Y.

**POWERFUL** Telescope Lens K-1—Compass F diameter 75' focus ob. active—40X and 100X astronomical eyepieces. Write them last \$1.95 postpaid. W. H. 40X terrestrial eyepieces \$2.95. P-2, P-3, P-4, P-5, P-6, P-7, P-8, P-9, P-10, P-11, P-12, P-13, P-14, P-15, P-16, P-17, P-18, P-19, P-20, P-21, P-22, P-23, P-24, P-25, P-26, P-27, P-28, P-29, P-30, P-31, P-32, P-33, P-34, P-35, P-36, P-37, P-38, P-39, P-40, P-41, P-42, P-43, P-44, P-45, P-46, P-47, P-48, P-49, P-50, P-51, P-52, P-53, P-54, P-55, P-56, P-57, P-58, P-59, P-60, P-61, P-62, P-63, P-64, P-65, P-66, P-67, P-68, P-69, P-70, P-71, P-72, P-73, P-74, P-75, P-76, P-77, P-78, P-79, P-80, P-81, P-82, P-83, P-84, P-85, P-86, P-87, P-88, P-89, P-90, P-91, P-92, P-93, P-94, P-95, P-96, P-97, P-98, P-99, P-100, P-101, P-102, P-103, P-104, P-105, P-106, P-107, P-108, P-109, P-110, P-111, P-112, P-113, P-114, P-115, P-116, P-117, P-118, P-119, P-120, P-121, P-122, P-123, P-124, P-125, P-126, P-127, P-128, P-129, P-130, P-131, P-132, P-133, P-134, P-135, P-136, P-137, P-138, P-139, P-140, P-141, P-142, P-143, P-144, P-145, P-146, P-147, P-148, P-149, P-150, P-151, P-152, P-153, P-154, P-155, P-156, P-157, P-158, P-159, P-160, P-161, P-162, P-163, P-164, P-165, P-166, P-167, P-168, P-169, P-170, P-171, P-172, P-173, P-174, P-175, P-176, P-177, P-178, P-179, P-180, P-181, P-182, P-183, P-184, P-185, P-186, P-187, P-188, P-189, P-190, P-191, P-192, P-193, P-194, P-195, P-196, P-197, P-198, P-199, P-200, P-201, P-202, P-203, P-204, P-205, P-206, P-207, P-208, P-209, P-210, P-211, P-212, P-213, P-214, P-215, P-216, P-217, P-218, P-219, P-220, P-221, P-222, P-223, P-224, P-225, P-226, P-227, P-228, P-229, P-230, P-231, P-232, P-233, P-234, P-235, P-236, P-237, P-238, P-239, P-240, P-241, P-242, P-243, P-244, P-245, P-246, P-247, P-248, P-249, P-250, P-251, P-252, P-253, P-254, P-255, P-256, P-257, P-258, P-259, P-260, P-261, P-262, P-263, P-264, P-265, P-266, P-267, P-268, P-269, P-270, P-271, P-272, P-273, P-274, P-275, P-276, P-277, P-278, P-279, P-280, P-281, P-282, P-283, P-284, P-285, P-286, P-287, P-288, P-289, P-290, P-291, P-292, P-293, P-294, P-295, P-296, P-297, P-298, P-299, P-300, P-301, P-302, P-303, P-304, P-305, P-306, P-307, P-308, P-309, P-310, P-311, P-312, P-313, P-314, P-315, P-316, P-317, P-318, P-319, P-320, P-321, P-322, P-323, P-324, P-325, P-326, P-327, P-328, P-329, P-330, P-331, P-332, P-333, P-334, P-335, P-336, P-337, P-338, P-339, P-340, P-341, P-342, P-343, P-344, P-345, P-346, P-347, P-348, P-349, P-350, P-351, P-352, P-353, P-354, P-355, P-356, P-357, P-358, P-359, P-360, P-361, P-362, P-363, P-364, P-365, P-366, P-367, P-368, P-369, P-370, P-371, P-372, P-373, P-374, P-375, P-376, P-377, P-378, P-379, P-380, P-381, P-382, P-383, P-384, P-385, P-386, P-387, P-388, P-389, P-390, P-391, P-392, P-393, P-394, P-395, P-396, P-397, P-398, P-399, P-400, P-401, P-402, P-403, P-404, P-405, P-406, P-407, P-408, P-409, P-410, P-411, P-412, P-413, P-414, P-415, P-416, P-417, P-418, P-419, P-420, P-421, P-422, P-423, P-424, P-425, P-426, P-427, P-428, P-429, P-430, P-431, P-432, P-433, P-434, P-435, P-436, P-437, P-438, P-439, P-440, P-441, P-442, P-443, P-444, P-445, P-446, P-447, P-448, P-449, P-450, P-451, P-452, P-453, P-454, P-455, P-456, P-457, P-458, P-459, P-460, P-461, P-462, P-463, P-464, P-465, P-466, P-467, P-468, P-469, P-470, P-471, P-472, P-473, P-474, P-475, P-476, P-477, P-478, P-479, P-480, P-481, P-482, P-483, P-484, P-485, P-486, P-487, P-488, P-489, P-490, P-491, P-492, P-493, P-494, P-495, P-496, P-497, P-498, P-499, P-500, P-501, P-502, P-503, P-504, P-505, P-506, P-507, P-508, P-509, P-510, P-511, P-512, P-513, P-514, P-515, P-516, P-517, P-518, P-519, P-520, P-521, P-522, P-523, P-524, P-525, P-526, P-527, P-528, P-529, P-530, P-531, P-532, P-533, P-534, P-535, P-536, P-537, P-538, P-539, P-540, P-541, P-542, P-543, P-544, P-545, P-546, P-547, P-548, P-549, P-550, P-551, P-552, P-553, P-554, P-555, P-556, P-557, P-558, P-559, P-560, P-561, P-562, P-563, P-564, P-565, P-566, P-567, P-568, P-569, P-570, P-571, P-572, P-573, P-574, P-575, P-576, P-577, P-578, P-579, P-580, P-581, P-582, P-583, P-584, P-585, P-586, P-587, P-588, P-589, P-590, P-591, P-592, P-593, P-594, P-595, P-596, P-597, P-598, P-599, P-600, P-601, P-602, P-603, P-604, P-605, P-606, P-607, P-608, P-609, P-610, P-611, P-612, P-613, P-614, P-615, P-616, P-617, P-618, P-619, P-620, P-621, P-622, P-623, P-624, P-625, P-626, P-627, P-628, P-629, P-630, P-631, P-632, P-633, P-634, P-635, P-636, P-637, P-638, P-639, P-640, P-641, P-642, P-643, P-644, P-645, P-646, P-647, P-648, P-649, P-650, P-651, P-652, P-653, P-654, P-655, P-656, P-657, P-658, P-659, P-660, P-661, P-662, P-663, P-664, P-665, P-666, P-667, P-668, P-669, P-670, P-671, P-672, P-673, P-674, P-675, P-676, P-677, P-678, P-679, P-680, P-681, P-682, P-683, P-684, P-685, P-686, P-687, P-688, P-689, P-690, P-691, P-692, P-693, P-694, P-695, P-696, P-697, P-698, P-699, P-700, P-701, P-702, P-703, P-704, P-705, P-706, P-707, P-708, P-709, P-710, P-711, P-712, P-713, P-714, P-715, P-716, P-717, P-718, P-719, P-720, P-721, P-722, P-723, P-724, P-725, P-726, P-727, P-728, P-729, P-730, P-731, P-732, P-733, P-734, P-735, P-736, P-737, P-738, P-739, P-740, P-741, P-742, P-743, P-744, P-745, P-746, P-747, P-748, P-749, P-750, P-751, P-752, P-753, P-754, P-755, P-756, P-757, P-758, P-759, P-760, P-761, P-762, P-763, P-764, P-765, P-766, P-767, P-768, P-769, P-770, P-771, P-772, P-773, P-774, P-775, P-776, P-777, P-778, P-779, P-780, P-781, P-782, P-783, P-784, P-785, P-786, P-787, P-788, P-789, P-790, P-791, P-792, P-793, P-794, P-795, P-796, P-797, P-798, P-799, P-800, P-801, P-802, P-803, P-804, P-805, P-806, P-807, P-808, P-809, P-810, P-811, P-812, P-813, P-814, P-815, P-816, P-817, P-818, P-819, P-820, P-821, P-822, P-823, P-824, P-825, P-826, P-827, P-828, P-829, P-830, P-831, P-832, P-833, P-834, P-835, P-836, P-837, P-838, P-839, P-840, P-841, P-842, P-843, P-844, P-845, P-846, P-847, P-848, P-849, P-850, P-851, P-852, P-853, P-854, P-855, P-856, P-857, P-858, P-859, P-860, P-861, P-862, P-863, P-864, P-865, P-866, P-867, P-868, P-869, P-870, P-871, P-872, P-873, P-874, P-875, P-876, P-877, P-878, P-879, P-880, P-881, P-882, P-883, P-884, P-885, P-886, P-887, P-888, P-889, P-890, P-891, P-892, P-893, P-894, P-895, P-896, P-897, P-898, P-899, P-900, P-901, P-902, P-903, P-904, P-905, P-906, P-907, P-908, P-909, P-910, P-911, P-912, P-913, P-914, P-915, P-916, P-917, P-918, P-919, P-920, P-921, P-922, P-923, P-924, P-925, P-926, P-927, P-928, P-929, P-930, P-931, P-932, P-933, P-934, P-935, P-936, P-937, P-938, P-939, P-940, P-941, P-942, P-943, P-944, P-945, P-946, P-947, P-948, P-949, P-950, P-951, P-952, P-953, P-954, P-955, P-956, P-957, P-958, P-959, P-960, P-961, P-962, P-963, P-964, P-965, P-966, P-967, P-968, P-969, P-970, P-971, P-972, P-973, P-974, P-975, P-976, P-977, P-978, P-979, P-980, P-981, P-982, P-983, P-984, P-985, P-986, P-987, P-988, P-989, P-990, P-991, P-992, P-993, P-994, P-995, P-996, P-997, P-998, P-999, P-1000, P-1001, P-1002, P-1003, P-1004, P-1005, P-1006, P-1007, P-1008, P-1009, P-1010, P-1011, P-1012, P-1013, P-1014, P-1015, P-1016, P-1017, P-1018, P-1019, P-1020, P-1021, P-1022, P-1023, P-1024, P-1025, P-1026, P-1027, P-1028, P-1029, P-1030, P-1031, P-1032, P-1033, P-1034, P-1035, P-1036, P-1037, P-1038, P-1039, P-1040, P-1041, P-1042, P-1043, P-1044, P-1045, P-1046, P-1047, P-1048, P-1049, P-1050, P-1051, P-1052, P-1053, P-1054, P-1055, P-1056, P-1057, P-1058, P-1059, P-1060, P-1061, P-1062, P-1063, P-1064, P-1065, P-1066, P-1067, P-1068, P-1069, P-1070, P-1071, P-1072, P-1073, P-1074, P-1075, P-1076, P-1077, P-1078, P-1079, P-1080, P-1081, P-1082, P-1083, P-1084, P-1085, P-1086, P-1087, P-1088, P-1089, P-1090, P-1091, P-1092, P-1093, P-1094, P-1095, P-1096, P-1097, P-1098, P-1099, P-1100, P-1101, P-1102, P-1103, P-1104, P-1105, P-1106, P-1107, P-1108, P-1109, P-1110, P-1111, P-1112, P-1113, P-1114, P-1115, P-1116, P-1117, P-1118, P-1119, P-1120, P-1121, P-1122, P-1123, P-1124, P-1125, P-1126, P-1127, P-1128, P-1129, P-1130, P-1131, P-1132, P-1133, P-1134, P-1135, P-1136, P-1137, P-1138, P-1139, P-1140, P-1141, P-1142, P-1143, P-1144, P-1145, P-1146, P-1147, P-1148, P-1149, P-1150, P-1151, P-1152, P-1153, P-1154, P-1155, P-1156, P-1157, P-1158, P-1159, P-1160, P-1161, P-1162, P-1163, P-1164, P-1165, P-1166, P-1167, P-1168, P-1169, P-1170, P-1171, P-1172, P-1173, P-1174, P-1175, P-1176, P-1177, P-1178, P-1179, P-1180, P-1181, P-1182, P-1183, P-1184, P-1185, P-1186, P-1187, P-1188, P-1189, P-1190, P-1191, P-1192, P-1193, P-1194, P-1195, P-1196, P-1197, P-1198, P-1199, P-1200, P-1201, P-1202, P-1203, P-1204, P-1205, P-1206, P-1207, P-1208, P-1209, P-1210, P-1211, P-1212, P-1213, P-1214, P-1215, P-1216, P-1217, P-1218, P-1219, P-1220, P-1221, P-1222, P-1223, P-1224, P-1225, P-1226, P-1227, P-1228, P-1229, P-1230, P-1231, P-1232, P-1233, P-1234, P-1235, P-1236, P-1237, P-1238, P-1239, P-1240, P-1241, P-1242, P-1243, P-1244, P-1245, P-1246, P-1247, P-1248, P-1249, P-1250, P-1251, P-1252, P-1253, P-1254, P-1255, P-1256, P-1257, P-1258, P-1259, P-1260, P-1261, P-1262, P-1263, P-1264, P-1265, P-1266, P-1267, P-1268, P-1269, P-1270, P-1271, P-1272, P-1273, P-1274, P-1275, P-1276, P-1277, P-1278, P-1279, P-1280, P-1281, P-1282, P-1283, P-1284, P-1285, P-1286, P-1287, P-1288, P-1289, P-1290, P-1291, P-1292, P-1293, P-1294, P-1295, P-1296, P-1297, P-1298, P-1299, P-1300, P-1301, P-1302, P-1303, P-1304, P-1305, P-1306, P-1307, P-1308, P-1309, P-1310, P-1311, P-1312, P-1313, P-1314, P-1315, P-1316, P-1317, P-1318, P-1319, P-1320, P-1321, P-1322, P-1323, P-1324, P-1325, P-13



**CAPITALIZE** inventions without patent expense. Patent guarantee no pretention. Send \$1.00 for booklet "The Patent Racket" and profit thereby. R. V. Co. Box 143, Easthampton, Mass.

**HAVE you a Patent?** Will manufacture on shares. Campbell, 373 Mt. Vernon, Detroit 3, Michigan.

**CASH** for practical ideas and inventions. Mr. Ball, BB-3441 Pleasant, Chicago.

#### FORMULAS, PLANS, ETC

**AUTHENTIC** Formulae 324 pages (illustrated) 10,000 Money making formulae, recipes, instructions substitutes, \$3.00 postpaid or C.O.D. (Foreign, \$2.35) Catalog, Adams-Brown, Chestnut Hill, Mass.

**FORMULAS**—All kinds. Latest money-makers; literature free. Kemp, Kal. Park Ridge, Ill.

**FORMULAS**—Latest, best Analysis. Literature free. E. Belfort, Engineering Building, Chicago 4.

#### FOR FARMING

**CHIN-CHIN** Giant Chinchillas. King of Rabbits. Most beautiful fur. Small investment. Large Profit. Free illustrated booklet. Willow Brook Farm, R.D. 18, Sellersville, Pa.

#### GAMES & ENTERTAINMENT

**READY** New 18th Annual Digest of Plays. Entertainment—Game Books, Musical Shows, Songs, Skills, Recitations, Operettas, etc. Invaluable to all organizations, families, individuals. Limited edition. Send 10c (covering postage-handling) for yours now! T. B. DeWitt & Company (Inc.) established 1874, 125 North Wabash Dept. 16 (74 Chicago)

**MAGIC** Fun Myself. Fool your friends! Over 200 boys and girls think to make fun and amuse. Easy to learn. Easy to perform. Sample trick and raising 10c. Fun Kit, 223 S. South Main St., Los Angeles 14 Calif.

**24 HOLLYWOOD** Postcards—Sentational "Postopust" game—Souvenir list—35c Postcards, Box 3150, Hollywood. (Remained free).

**PLAY** the World's Fascinating Game. "Character Reading". Free particulars. Spada, 227 Front, Hartford 3, Conn.

#### GARDENING

**400 VARIETIES** Dahlias, ask for 40 page book. Springhill Dahlias Farm, R. 2, Box W Grand Rapids, Michigan.

#### HEARING AIDS & REPAIRS

**HEARING** Aids, Repairs, and Batteries. Quick Service, Wholesale, retail guaranteed. Marshall Brown, 19 East Congress Street Chicago 1, Ill.

#### HIGHGRADE SALESMEN

**ADVERTISING** Book Matches—World's largest "Direct Selling" Book Match Factory offers advance cash earnings calling on every type of business. Men or women. Experience unnecessary. Part-time. Low Pay. High Quality. Quick Delivery. Powerful Payroll. Display Special Designs for Army Camps and Home. National Repeat Free K.I. Instructor Match Corp. of America 1433 West 48th Pl., Dept. N 2, Chicago 12

**ADVERTISING** Book Matches. America's largest manufacturer of Up-on Label Book Matches. Fast selling line. Large sales producing list. Sample matches. Complete cut catalog 17 color combinations makes selling easy. Commission in advance. Superior Match Company 1430 Greenwood Ave. Dep. P 2 Chicago

**SELL** Warm Leather Jackets to friends, neighbors. Make money spare on 1 time. Also Rubber Raincoats 200 styles shoes. Sample Outfit Free. Experience unnecessary. Mason, Dept. M-127 Chippewa Falls, Wisconsin.

**SALESMEN**—Saleswomen: \$c (cost to you) article sells on sight to workers everywhere for 25c. Make \$4 to \$10 day easy. Sample 25c coin. Bramley Products P.O. 1026 Champs Denver 4, Colorado

#### HOBBIES, COLLECTIONS

**GENUINE** agates cut and polished ready to mount in rings, brooches, and lockets. \$3.00 each set fully guaranteed. Turn Around Agate Shop, Agate Beach, Oregon.

## POPULAR SCIENCE Opportunities

**UNITED** Match Book Covers 100 all different \$1.00 15 Royal Flush Covers \$1.00 Free list. Charles Edelman, 1311P East 84 Cleveland 3, Ohio

**ABALONE** She is a Beautiful Brilliant Natural Ash Tray Two for \$1.00 six for \$2.00. I will post collect. Abalone Shells Box 212, Fort Bragg California

**GENUINE** Arizona Ruby and Desert Soap. Send Quarter for both. Mineral Specimens Company Box 3431 Phoenix 4, Ariz.

**BEAUTIFUL** Stones removed from rings, etc. 100 assorted \$2.00. Lowe's, Box M 311 S. Louis 1 Mo

#### HOME CRAFTSMEN

**CRAFTSMEN** make your hobby pay! Reproduce original works or anything, using Real-Ruby Flexible Moulds \$1.50 pound. Carve large Carvabloc with directions and patterns \$5c. Make toys and lawn ornaments with 3-color-patterns 25c. All sent postpaid and guaranteed. Real Studios, Inc. Whitestone, N.Y.

**SQUAREKNOTTERS!** Make belts, hand bags, etc. Quality cord samples with catalog free. Big color book catalog and samples 10c. Special! Regular \$1 book with 50c beginner's outfit, all for \$1. F. C. Herwig Co., Dept. P-42, 121 Santa St. Brooklyn 4 Y

**28 LAWN** Ornament patterns 25c. Other patterns 10c. 30" high Dutch girl, Dutch boy, etc. bull terrier, Mexican girl. Mexican boy dwarf piglets. Doves etc. 10c each. 3 for 25c. 35 variety patterns 30c. All 43 full size patterns \$1.00 postpaid. Brother Box 143 20 Belton Va

**CATALOG** Toys, Decs, Transfers, Patterns, Novelties, Fun, etc. Lawn Ornament, etc. Schedule for 1944. Name and Order List. See articles freely in office. Write Wo-Me's Shop, Ashburn, Georgia.

**RELIGHT** and use burned-out fluorescent Tubes Indefinitely. Easy to do. Complete information \$1.00. Research Labs 2414 S. 31st St., Council Bluffs, Iowa

**148 ANTIQUE** Firearms, Swords, Rifles, Cartridges Indian Relics, Mounted Animals, etc. Catalog 10c (Photographs of Most) Heike, Wenona, Illinois

#### HUNTING

**BROT** Cash for 3000 Ours or Ammunition! Or Trade for merchandise in our Winter "Guaranteed Bargain Catalog" listing thousands of Guns and "Hard-to-get" items. Send 25c for Catalog (refunded with first order). We pay More for Less because we handle thousands of guns in all models, gauges, calibers both new and used from \$5 to \$1000. We also buy or trade Reels, Rods, Outboards, Firearms, Cameras, Radios, Watches, Diamonds. Name your own price! Delivery guaranteed. Free 10c Money Back Guarantee backed by two generations of honorable dealing. Write Sporting Goods Box 500 South Main Chicago

#### INFORMATION

**INFORMATION**—Have to locate most any article made in the United States. (Dine coin). Makes Specialty Service, 1040 West Monroe St., Chicago 6, Illinois

#### INVENTIONS WANTED

**ALL** Kinds. We have facilities and finances to make and sell your ideas both mechanical and chemical. Send model sample, details and your wishes. General Sales & Supply Company 119 East Main Street, Madison 3, Wisconsin.

**WANTED** good post war inventions. All kinds patented, unpatented. Booklet, references, free. Invention Reporter, 13-11236 S. Fairfield Chicago

**CASH** for Inventions—Patented, unpatented. Mr. Ball, BC-3441 Pleasant Chicago

**INVENTIONS** Promoted Patented or Unpatented. Write Adam Fisher Company 183 A Knight, St. Louis, Mo.

**SELL** your ideas or patents on a automotive service tools to tool manufacturer, 3131 Avenue U, Brooklyn, New York.

**PATENTED** and unpatented inventions bought and sold. M. Joyce Humphries, 812 Otis Bldg., Philadelphia, Pa.

#### JEWELRY

**GENUINE** diamonds, out-of-pawn low prices. Trade full value. U redeemed loans and big buying power enable us to offer beautiful gems at prices far less than original cost. Shipped Free for inspection. Appraisal. Send for Big Free list showing fine diamonds at startling low prices. Lloyd J. Butler, President, Prudential Loan Association, 133-OB North Clark St., Chicago 3

#### LEGAL DIRECTORY

**MEXICAN** Legal Matters reliably handled. A. Munoz, 140, Juarez, Mexico

#### MACHINERY, TOOLS & SUPPLIES

**NOW**—Lewis Castings, Materials, Blueprints are available on M.R.O. ratings for building Mills, Shapers, Vices, Drill Presses and many other useful machine tools. Hundreds of shops are making greater profits from War Work with Lewis Tools. Write for illustrated catalog describing 23 items—engine 10c. covering making cost. Lewis Machine Tool Co., Box 114, Station A, Dept. 834, Los Angeles 31, California

**INDEX**—Heads for sale. Very inexpensive. Sixty-two different divisions. Used on small lathes, drill press, milling machines, etc. Make gears, hobbs, cutters, etc. Very accurate, and durable. Not a toy. Used by defense schools and hobbyists. Write for free folder. Long's Index Heads, 2117 East 15 St., Torrington, Wyo.

**BRINKS** Bargain Bulletin, 30 big pages of eye popping bargains and hard to get tools, machines and supplies, for all shops. January issue ready for 30 cents or 3 months for \$1.00. Mechanics Books with free premiums. H. A. Brinkerhoff Inc. 31 Walker St., New York City

**SCREWS**—Nuts—Bolts—Washers—Rivets—Brackets etc. Ready assortment for mechanics, garages—household use—workshops. Over 1000 pieces 5 full pounds. Satisfaction guaranteed. Special \$1.00. Limited supply. Order now. Wadon Distributors 214 W. Hubbard Chicago

**BUILD** your tractor from second-hand automobiles! Convert your horse drawn farm equipment into tractor drawn equipment. Novak's Garage, East Waukegan, Mass.

**'SEESAW'**, new invention, does impossible as like riding around corners you can't see a road. Free literature. Dupont, 1216 Park Row Building New York 7

**STEEEL** beam trammels for draftsmen, engineers, mechanics. Circular Free. Clair Company, Box 92, Blythebourne Station, Brooklyn, N.Y.

**NEW** caliper, direct reading, speeds up defense work, cheap. Free illustrated circular. Factory 311 E. East 3rd, Kansas City Mo

**DIAL** indicators for sale. To defense shops and machinists only. Readings 00, 0003. Amity Products, Box 341D, Waltham 34, Mass.

**GRIND** Drill Like Factory Attachment for Bench Order Cheap Factory, 311 A East 31 Kansas City Mo.

**RECLAIM** dull and broken drills with Nu-Way Drill Grinder Circular Free. Tractor-Lite-Mfg. Co., Spirit Lake Iowa

**SHARPEN** Drill like factory, free particulars. 448 Buena Vista, Burbank, California.

**FIVE** assortment new used H.S. tools Box 493, Flint, Michigan.

#### MAGIC TRICKS, PUZZLES, JOKER NOVELTIES

**1943 EDITION** Douglas Famous Catalog of 500 Tricks you can do. At the latest with cards, coins, thumbtacks, balls, ropes, apparatus, books, illusions. 128 pages only 10c. Douglas Magaland, Dallas, Texas

**BE** a Magician. Large professional magic catalog of latest tricks 25c. Ireland, P-106 North Dearborn, Chicago



**QUALITY** Magic since 1907. Three new catalogs ready, twenty five cents each. Book catalog and lists free. Thayers, Box 1785, Wilshire-La Brea Station, Los Angeles 15, Calif.

**HOLLYWOOD** Special! Magicians button, catalog, ghost illusion and free trick for 25c. Magic House of Charles, Box 8885, Hollywood Calif.

**WORLD'S** largest professional magic shop keeps you in touch with latest tricks. To receive mail send 25c for 1943 catalog. Holdens, P-220 W 43rd St., New York.

**MAGICIANS'** Gamblers' secrets exposed. Cards, Dice, Punchboards, Slot Machine Catalog 10c. Book Co., Box 871, St. Louis 1, Mo.

**AMAZING** Mystifying Tricks. Make Money Entertain friends. Big magic package 25c. Pioneer Magic Studios, 4418-PS Clarence, St. Louis 15 Mo.

**JOIN** Magicians' Fraternity! Monthly magazine of tricks, sample 10c. International Magicians, Mount Morris, Ill.

**YOUR** name screaming headlines. Hollywood newspaper 25c. Lefavor Arrowhead Springs San Bernardino, Calif.

**MAGICIAN'S** Headquarters, 218-page illustrated catalog, 25c. Kanter's, 8-1311 Walnut, Philadelphia 7, Pa.

**HYPNOTISM!** 100 books, courses for sale. List, 25c. Nelmar 2851 Milwaukee, Chicago.

#### MANUFACTURING

**MODELS**, small lot manufacturing, metal, plastic, etc. McBurn, Burlington, Kentucky.

#### MILITARY INSIGNIA

**SILK** embroidered Service Emblems, Sample and price list, 10c. Insignia Guide, 10c. Emblems made to order. Hobbyguild, 35-X West 32nd, New York.

#### MISCELLANEOUS

**MEDICAL** Laboratory Technicians in great demand. We train you in your spare time, in your own home. You can practice while studying. Write for free catalogue. Imperial Technical Institute, Box 873 S. Austin 5, Texas.

**LOOK** Folks, it's only a quarter. Send four lines of your handwriting for analysis. Entertainment 10c. For fun try it. Hurry now! Handwriting Expert 1042 179th St., Jamaica 3 New York.

**COMIC** pen and ink sketch made from your photograph. Picture returned unharmed. 5c. hobby or pastime. Send photo and 5c. to Core Wright Artwork Grandy Calif.

**MOONS** Planets By The Moon Fishing By The Moon. 1944 Moons and formulas 25c each. Planetarium Box 3445, La Jolla, California.

**ENLARGERS**—Build your own Kit of parts \$4.00. Free particulars. Crescent Engineering, Box 261-C, South Pasadena, California.

**GREAT** Fun, Pin-ups, Fun cards, Souvenirs, sparetime offers, 10 cents. Details, commission circulars Free, Box 48, Brooklyn 25 N.Y.

**RECEIVE** mails, magazines, samples. Your name in numerous mailing lists 10c. Howard, 396 Broadway, New York.

**FREE** lists are how to locate buried treasure and minerals. Fisher Laboratory Paid Ad Co. Calif.

**SELL** by mail. Progressive Mail Trade. This how Rampart 10c. Ray Hanks, 21 Mariner St. Buffalo 1 N.Y.

**AMAZING** new, easy way to succeed through Auto-Hypnosis. Free information, Victor, 875 Elliot, Denver 4, Colorado.

**CHILBLAINS**—cured—Old Indian Remedy \$1.00. C. E. Barks, Agate Beach, Oregon.

**UNPAINTED** Wall Plaques 25c up. Write Oman, 442 Broadway, St. Paul, Minnesota.

**BIG** mails, magazines, samples, opportunities, dime. Edward Lau, Box 1248, Honolulu, Hawaii.

**RARE** Garden Seeds, list free. Green Valley Gardens, 126 N. Main, Tulsa 3 Okla.

**HEATING** six rooms \$20 yearly. Circulate 10c. Rosenzweig RR4-83, Cincinnati.

#### MODELS & MODEL SUPPLIES

**SHIP** model kits and fittings. Complete line Fisher model yacht equipment. All Brother Fisher Marine Model and Ideal Kit fittings and blueprints at standard prices. Most complete stock in New England. James Pines & Co. Inc. 230 State St., Boston Mass.

**COMPLETE** Kits Ship Models Coach Models. Covered Wagon. All parts cut to fit. No shaping required. Tack hammer only tool needed. Everything included—cath. wire and rigging. Send 3c stamp for catalog. Miniature Ship Models, Dept. N, Perkasie, Pa.

**MOST** complete Illustrated Catalog—"OHO OO Model Railroad Parts" ever published. Send 5c for mailing. Selby, 1377 14th Ave., Dept. 802, Brooklyn, N.Y.

**RAILWAY** models complete line informative catalogs. O Gauge 104 pages, 25c. HO 48 pages, 15c. Walthera, 249 Erie, Milwaukee, Wisconsin.

**PLANES** Boats Hundreds of Hobby Items Catalog 3c. America's Hobby Center, Dept. 5-24, 40 E. 31st St., New York 10, N.Y.

**CATALOG** 30 engines, model railroad supplies 25c. Referred. Howard, P 3417 North Ashland Chicago.

**ILLUSTRATED** Price List. Models. Propellers. Supplies 3c. Model Makers Supply H. Chisholm Kansas.

**SHIP** Model and yacht supplies complete. Large 44 page Catalog 25c. Wm. Wind, 510 E. 14th St. New York City.

#### MONEY MAKING OPPORTUNITIES

**OPPORTUNITIES** Glorious New fascinating variety home work earning big money. Also step by step, push button, Money Making Public Speaking 25c. Book 10 page HomeScope two dollar money making magazine catalog 4c. Send business W. Blumhag 210 Fifth Avenue, New York.

**MECHANICALLY** Inclined Men. Own and operate general Appliance Repair shop. Complete illustrated course shows you how. Welding. Refrigeration. Motor repair. How to get business and phases covered. Free literature. Christy Supply Dept. 1436 28th N. Cedar, Astoria, Ore.

**BLIND** Deaf. Starts Dollars your way. New "Kojinizer" Ads Bring Cash. You get membership, magazines and over 20 Red Hot Money Making Items with Mammoth Mail order year "Leaderade" 319 S. Main St. Pasadena 5 Calif.

**LEARN** Metascience. Remarkable drugless healing. No manipulation. No apparatus. Unbelievable simplicity and results. Free personal correspondence now. Write Metascience, De Land, Florida.

**SALESMEN** Agents Home Workers get new offers as and names ever. Write 25c. ad's yours. Hudson Service, 1472 Broadway, New York.

**AMATEUR** and semi-professional artists and cartoonists, cash in on your ability. Hamilton, Box 48, Woolsey Bldg., Astoria, New York.

**IF** you want to swap by mail anything send for Swappers Guide. It's full of opportunities. 20c copy, Swappers Guide, 610 St. Joe, Evansville, Indiana.

**MAKE** Money With Hobbies! New book reveals many money-making plans for hobbyists! Only \$1. S. Hahn, 443 Bergen, Jersey City 4, N.J.

**NEW** Drugless Therapy. Simple Techniques, but Dynamic! No apparatus! No Manipulation! Metabolic Station 59126 Los Angeles.

**SELL** envelopes by mail. Wholesale spare time. Big profits. Omaha Envelope Service Dept. 5 521 California Omaha 3 Nebraska. Established 1930.

**MAIL** Order News brings proven tested money makers to start your own business. Sample copy 25c. Meeks Pub. Box 707 Weed California.

**MAKE** money at home by mail in your own sparetime side line business. No experience or large capital necessary. James Box 1436 Long Beach California.

**EARN** money evenings copying and duplicating comic cartoons for advertisers. Comic-Ads, Argyle, Wisconsin.

**OPPORTUNITIES** Glorious, giant mails 10c sample mailing free. Harvey Teeple (PH), Decatur, Ind.

**DETECTIVES** Earn Big Money. Experience unnecessary. Particulars free. Wagoner, P. 23 West 80th, N.Y., N.Y.

**MAILORDER** Income Boundless opportunities. Particulars stamp, MacMillan, 7311 Lancaster Ohio.

**UP** to \$5,000.00 yearly with ten acres. Plans \$1. "Tenacres", Box 2348-F, Hollywood, California.

**MONEY** By Mail-Descriptive Literature—10c. "Novel Enterprises" Reno 31, Nevada.

**TRADERS'** Club members earn big money because? Anderson, Vineburg, Calif.

**SEVEN** Leading Mail Order Magazines-25c. Novel Enterprises, Reno 30, Nevada.

#### MONUMENTS

**MONUMENTS** Direct Low Prices. Freight paid. Guaranteed. Free Catalog and samples. Write Granite-Marble Factory, A19, Oneco, Florida.

#### MOTION PICTURE & SOUND EQUIPMENT

**CHIANG** KAI-SHEK, Roosevelt, Churchill. "Big J Conference" 8MM-16MM Silent-Sound Tremendous Library. Films rented everywhere. Free catalogue, (sample film 10c), Garden Film, 317 West 80th, New York.

**EIGHTEEN** pretty Girl 8-16mm, film subjects. 1 set sample dime. Our latest. Love from 30 ft. \$2.00 16mm 100 ft. \$4.00. Also beautiful 8 16mm Kodachrome productions. Jenkins, 392-A Knudsen, N.Y.

**JOIN** our new Home Movie Film Club. Silent or Sound 8, 16mm. Film exchanged at lowest rates. Particulars free. National Film Exchange, 514 E. Broadway Toledo, Ohio.

**FREE** illustrated 1944 Home Movie Film and accessories catalog also big list of Rental Films. Low Rates. Kaco Film Productions, 2427 Archer Avenue, Chicago 32, Illinois.

**MOVIE** Camera Outdoor Film, 100 ft. roll 16mm \$2.50; 25 ft. roll Double 8, \$1.25. Free literature. Sel, Film had Subject Catalog. Better Films, 742 New Lots Brooklyn 1 N.Y.

**"THE** World's Greatest Passion Play. 8mm, 16mm and 35mm. Specify size and quantity. Rent or purchase. Include stamp. Hemisphere Film Co., 33-Z Melrose, Boston 15 Mass.

**GUARANTEED** Fresh Movie Film! Three spools double 8mm \$3.49. 8c. spools. Under \$2.99. Double loading! (Limit one each type.) Will ship C.O.D. Film Films 3945 Central Kansas City 2, Missouri.

**DIVERSION** from Film presenting air beautiful girls. 50 feet \$2.00. Lists included. Winchok, Woodbine 61 Pennsylvania.

**100'** 16 MM. Used sound film. \$1.00 postpaid. Write for list of complete subjects. Bickshaw Films Dept. PH4 Dan expert 1 wa.

**TAKE** money 100 16mm \$1.00, 25' double 8mm \$1.25 developing included (Bulk) Film Ambassador 419-A Quincy St. Brooklyn N.Y.

**MOVIES** 8mm-16mm Gorgeous Kodachrome Subjects also black and white Glamour Films. List free with sample. Write Ketter 42 PM Corning New York.

**8MM** SOUND features! Short! Technicolor samples 10c. Demsey, 1413 Stewart, Youngstown, Ohio.

**LEARN** Movie Projection, Management. Free catalog. Give age. Theatre School, Elmira N.Y.

**I** BUY—swap—Rent—Sell 8mm, 16mm movie films. Harvey Irla, Box 539 Brockton, Mass.

**NEW** Movie Films—Wholesale! Free Catalog. Sample Samples, 10c. Superior 126 Fourth Paterson New Jersey.

**PROJECTORS**. Cameras, wanted quick buy or trade, Good Prices Paid. Goodwill Co., Jackson, Tennessee.

**SALE**—rent—exchange—8-16mm movies. Send stamp for catalogue. Bailey Films, 1653 Coamo, Hollywood 28, California.

**SEND** stamp for 16mm, 8mm catalogue. Sterling's, 879 Northampton, Easton, Pa.



## MOTORCYCLES, BICYCLES & SUPPLIES

**MOTORCYCLE Manual**—192 Page American Questions Answered complete servicing information on Harley, Indian, Henderson, Servicycles. V. L. Lera included up war models \$1.50 — **Two Stroke Motorcycle** \$1.50 — **Modern Motorcycle Mechanics and Speed Tuning** 435 pages care and repair English Motorcycles \$2.50 with drawings specifications U. S. Army Jeep German War Motorcycles \$1.00 A1 postpaid. Clavier 225 W. Pico, Los Angeles 6, Calif.

**MODERN Motorcycle Mechanics** 435 pages, 200 illustrations Extra service covering operating, maintenance, complete reconditioning, American and British motorcycles. Invaluable to motorcycle riders or mechanics. \$2.50 postpaid. Nicholson Brothers Books Corp. Canada

**108 MILES An Hour Motor Scooters** Motorcycles Whizzer B. & E. Foxes Midget Automobiles O. A. E. Foxes No priority Necessary. Full information prices illustrated catalog one dollar. Clavier 225 W. Pico, Los Angeles 6, Calif.

**PLANS** Drawings specifications, instructions for building miniature Motor Scooter complete \$2.00. Plans in sections—E-Z to make your bicycle electrically driven \$1.50. Scooter Catalogs 10c Clavier 225 W. Pico, Los Angeles 6, Calif.

**ARRIVED** carload motorcycle parts for Harleys and Indians. Write us your needs. McCann's, 2104 Texas Street, El Paso, Texas

**WANTED**—Midget cars, scooters, motorcycles, engines, parts. Name your own price. Write Midget Motors Directory Athens, Ohio

**BEAUTIFUL Repair Motor Scooters** Tires. Information catalog 10c Clavier, 225 W. Pico, Los Angeles 6, Calif.

## MUSIC, MUSICAL INSTRUMENTS

**LEARN Popular Piano** Play hit songs in book & sing them. Piano's send me for sample arrangement Home study. Free or free. Christensen Studios, 765 Kimball Hall, Chicago 4, Ill.

**SONOWRITERS** Send your poems for our offer and Free Rhythmic Du. onari Phonograph Records made. Send hit Music Studios, Box 112, Dept. 4B, Coney Island, N. Y.

**PIANISTS** Quickly Improve Technique Nightingale, Accuracy Memory and Playing thru Mental Musical Organization. Free booklet, Broadwell Studios, Dept. 24B, Covina, California

**LEARN Piano** in 5 easy lessons by ear. Play any song—Easiest method known. Amazing results. Complete course \$2. ABC Piano Method, Dept. B-2, Mt. Vernon N. Y., Box 145.

**JAZZ records** Know current values. Monthly subscription list gives prices. Subscription \$1.00 yearly. Sample free. Call to Record Shop, 825 Seventh Avenue, New York City

**SONOWRITERS** Write for Free Instructional Booklet Outlining Opportunities. United Music Corporation, Dept. 31, Salem, Indiana

**HEAD Play Piano** 32 lessons self instructor, \$1.35. Moses, 315 W. 86th New York 24

**WANTED** Lyrics melodies for songs. We arrange publish, sell. Superior Song Studios Passaic N. J.

## OLD GOLD, WATCHES, PRECIOUS STONES

**GOLD \$35.00 Ounce**—Mail old gold teeth, diamonds, jewelry watches receive cash by return mail. Satisfaction guaranteed. Free information. Dr. Weisberg's Gold Refining Company 1400-B Hennepin, Minneapolis, Minn.

**MAIL old gold and silver watches** gold teeth rings jewelry diamonds (any condition). Cash return mail \$3.00 to \$500.00 worth most homes. Satisfaction guaranteed. Information on free Jewelry Salvage Service Box 103-P, Depew, N. Y.

## OLD STAMPS WANTED

**I WILL pay \$130.00 each** for 1934 1c green Franklin stamp rotary perforated eleven (up to \$1,300.00 each unused). Send \$c today for large illustrated to der showing amazing prices paid. Vernon Baker PS 42, Elyria, Ohio

# POPULAR SCIENCE Opportunities

## PATENT ATTORNEYS

**INVENTORS** Learn now—without obligation—how to protect and sell your invention secure Free Record of Invention form for establishing date of your invention and Free Book Patent Guide for the inventor containing complete information about patent procedure and selling inventions, giving illustrations of many successful inventions, over 150 basic mechanical inventions. Delay may be costly. For prompt confidential service at Clarette A. O'Brien & Harvey Jacobson, Registered Patent Attorneys 418-B Adams Building, Washington, D. C.

**INVENTORS** Before disclosing your invention to anyone send for Form "Evidence of Conception," "Schedule of Government and Attorney's Fees" and instructions. Sent free. Laboratory Allure & Remme, 412 Bowen Building, Washington, D. C.

**PATENTS Secured** Two valuable books: "Patent Protection" and "When and How to Sell an Invention" together with valuable "Evidence of Invention" form sent free. Write immediately to experienced patent attorneys Victor J. Frana & Co., 811 B Madison Bldg., Washington 6, D. C.

**INVENTORS** Send for free copy my 72-page book on patent's Reasonable terms. Prompt and confidential personal service. L. P. Randolph, Dept. 340-A Washington 1, D. C.

**PROTECT** your invention through medium of our expert personal service. Preliminary information without obligation. Howard I. Healy, 902 F Street N.W., Washington, D. C.

**PATENTS**—Trade marks, Preliminary advice, book and disclosure form free. Personal service. Irving L. McCallan, 316 McLachlen Bldg., Washington 1, D. C. Registered Patent Attorney

**INVENTOR'S GUIDE** free containing 100 mechanical movements information about patenting and inventions. Park B. Lederer, 154 Nassau St., New York

**C. A. Snow & Co.** 3427 Arrow Bldg., Washington 1, D. C. Registered Patent Attorneys. Established 1875. Literature mailed on request.

**PATENT** Particulars and Blanks, free. Alarmed Sterling Buck, P. Hotel Plaza Washington 7, D. C.

## PATENTS

**INVENTORS** Foresighted manufacturers already planning post-war sale of new non-military products. If you have a useful invention patented or unpatented write Chartered Institute of American Inventors, Dept. 3-B, Washington, D. C.

## PERSONAL

**HEALTH** Dear Reader Learn about Dr. Chirila's Unusual new development of diagnosis of the supposed causes and eliminate treatment of Malignant and Chronic Ailments. Descriptive literature mailed free. Dr. Chirila's Health Clinic, 706 East Jackson Blvd., Elkhart, Indiana

**HEALTHY Hair** I stopped my hair falling out and quickly freed it of dandruff. No tonics, medicines or appliances used. Just nature's easy way. My secret method \$1. (No stamps please). J. Finn, 3723 Grand Avenue, Oakland 18, California

**PSORIASIS Sufferers** Pixacol has brought relief when everything else failed. Use only as directed. Apply externally. Does quickly convenient. Try regular \$1 bottle without incurring a cent. Write Pixacol Lab., Box 1294, Cleveland 3, Ohio

**HEALTH** Rejuvenation. My treating tells how I overcame nerves exhaustion high blood pressure colitis heart tension indigestion eyestrain and found a new life. Enclose \$2 or C.O.D. Refund if unsatisfied. Casper 426 Marston St., Brooklyn N.Y.

**ANYONE** can learn Silk Screen Process Reproduction. A marvelous opportunity for artists, sign writers, teachers, printers, hobbyists. Write for Brochure Modern School of Process 7118 S. Spaulding Ave., Los Angeles 16, California

**SLEEP** Right every night with "Sleep-Tite" Soft Waxen Ear Nose Stoppers. Sample Free. At your local druggist or Dorpos, 1215 Park Row Building, New York 7.

**ADVICE** on Hypnotism! Two questions fully answered, \$1.00 by expert Hypnotist. 100 various books, courses, techniques for sale. List, 25c. Neilmar, 2851 Milwaukee, Chicago

**LEARN** to get what you want! New 300-page book "7 Steps To Personal Success" gives you 300 practical guides for economic social betterment, \$2.00 postpaid. Mentor House, 270 Broadway, New York City

**OLDER** Men find new pep and youthful vigor in amazing new Hindu secrets. Details Free. Hindu, 875 Elliot, Denver 6, Colorado

**PSORIASIS**—Dry External Rub name for amazing facts, special No Risk Offer, Carter Howell Laboratory 457 Schenectady Avenue, Dept. M, Brooklyn N.Y.

**PIN-UPS** Biggest Line. World's Most Gorgeous Girls To-day's Biggest Bargain Assortment \$1.00. James Reed, P-8-31, Hullis 7 N.Y.

**LEARN** Ventriloquism, 3c stamp brings particulars. Smith, Dept. 310, 601 Bigelow Peoria, Illinois

**MOTORISTS**—Red and White key chain and license holder 2 1/2" long. Send 25c. Box 262, Haverhill, Mass.

**HYPNOTISM** Complete 20 Method Course, The Western Institute Hypnotism, Dept. 119, Palestine, Ill.

**BIRTH** Certificates, marriage, other records, Persons located, Bureau of Records, 308 West Washington, Chicago 6

**WOULD** you like your eyesight improved and discard glasses? Send \$1.00 for full instructions. L. P. Near, Lake Worth, Fla.

**SEND** \$1.00 Roy's Stomach Tablets 100. Relief or Money Forward Company, Duluth, Minn.

**BUY** Vitamins direct. Save. Postcard Matoska Products, White Bear Lake, Minn.

**PENMANSHIP** Corrector—Corrects your penmanship few hours. Trial, Write, Orment, 6, St. Louis, Missouri

**HORRIES** Pay Off. Learn how from profitable new book. Send \$1 today! S. Hahn, 445 Bergen, Jersey City 4, N. J.

**14 METHODS** of locating missing persons. 25c. Jones Service, 1144 Webster, San Francisco 15, California

**PRET** Hurt? Cure 'em, then cure others. Details Dine Sawyer 731P Ocala, Florida

**NERVOUS** Conquer fear, worry, heart disease! Free. Special Information, John England Box 336, Ironwood, Michigan

**BONE** Flour to halt tooth decay. Sample dime. McFerrin, Orlando, Florida.

## PHOTO FINISHING

**TIE** and wrap rolls securely. Do not mail in ordinary envelopes. Address plainly.

**SENATIONAL** introductory offer! Send negative this ad and 3c for professional 7x5 enlargement! 16 regular size or 8 10x12 size prints from negative 25c! Katak roll developed with 16 guaranteed double edge prints 25c. Candid Roll—36 exp 35mm developed, captioned, enlarged to 3x4, \$1.00. 18 exp 40c. Reprints, 3x4, 3c each. We have new perfect 35mm film. Low prices. Free. M's. lers. details on request. American Studios, Dept. 207, LaCrosse Wisconsin

**BEAUTIFUL** 4 x 6 pictures 3 1/2c each, from 116 and 120 negatives, 3 1/2 x 4 1/2, from all other sizes. A, work guaranteed. Overnight service. Roll developed and 8 pictures 30c. Roll 12 pictures 45c. Roll 16 pictures 60c. Enlargements on double weight portrait paper 5 x 7—30c, 8 x 10—50c. Copies made from any picture 75c. Pacific Photo Service, Box 646, San Francisco, Calif.



35-mm. AROUS, Leica, etc. (except "Mercury") 35 exposure rolls, fine grain developed (Eastman DK 70) and beautifully enlarged to 3 1/4 x 5 1/2 easy print 90c Cartridge reloaded, 35c 18 exposure roll 55c reload 20c 24 hour service Satisfaction guaranteed. Free mailing bags, sample print. Technifinish Laboratory, 38-63 63rd St., Rochester 4, N. Y.

**BIGGEST \$1.00 value in 1944** finishing today 36 exposures, fine grain 3 1/4 x 5 1/2, enlargements deckled embossed margin and date. Eighteen exposures 7c sixteen exposures 4c 12 exposures 3c. Free mailers 8 exposures rolls in beautiful, deckled contact finish with embossed wide margin, 20c Mailbox Film Service, Box 8440A, Chicago 80

**OIL** coloring photographs a fascinating hobby or profitable business. Learn at home. Easy simplified method. Previous experience unnecessary. Send for free information and requirements. National Art School, 1315 Michigan, Dept. 1721 Chicago.

**ROLL** Developed and 8 beautiful enlargements 2 to 4 times larger. Deckled Edge—High Gloss. Any 8 exposure roll 25c roll 12 ex 35c—16 ex 50c—24 ex \$1.00. Reprint Enlargements 1c each. Alden Photo 84 4 Astor St. Boston, Mass.

**YOUR 8 8 Exposure Roll** developed and Two prints each good negative, 30c or enlarged to about Post Card size 8 exposures 40c; 16 exposures 80c. Rapid Photo Service G.P.O. Box 413, New York 1, N. Y.

**REPRINTS** 30 each (fifty or more) less than fifty 2 1/2c each. Finest workmanship, fast service. Mercury, B-109 North Dearborn, Chicago 7

**INTRODUCTORY Offer**—six enlargements from your favorite negative, 25c. Skyland Studios Box 411 Dept. 25, Asheville N. C.

**ROLL** Developed, photo album, 3 enlargements, 8 prints 25c. Coppert Studios, Dep. J 4 Des Moines, Iowa.

#### POULTRY & SUPPLIES

**LEARN** about Wartime Poultry Raising. Real profits can be yours raising Poultry the "American Way". Monthly helps and suggestions, short cuts that save time and money. Free bulletins. Personal help from poultry experts and monthly poultry magazine published since 1924. Costs less than 3 cents monthly, 25c year; 5 years \$1.00. Send coin or stamps today. American Poultry Journal, 539 S. Clark, Chicago

**ABOUT 20 A Month** brings you money-saving tips from experimental farm. One year 25c 5 years \$1.00. Subscribe! Poultry Tribune Dept. 152 Mount Morris 1

#### PRINTING, LITHOGRAPHING, MINERGRAPHING, LABELS

**PRINTOMATIC** Self-feeding Rotary Stencil Post Card Printer 99.50 Complete. All Makes Duplicator Supplies. Literature Free. Pittsburgh Typewriter Supply 336 MA Fourth Avenue, Pittsburgh 22 Pa.

**\$2.00 POSTPAID** 200 3 1/2 x 1 1/2 Good Hard Letterheads and 200 4 1/2 x 7 Envelopes. Set of each 24 75c postpaid. Mero Products Box 344 Piquette Ave. Pa.

**PRINTING** of all kinds. Write for price list and samples. Edgewood Press, Box A, Edgewood, Maryland

**BUSINESS** Cards, printed in two colors. \$2.50 per thousand. Samples on request. M. Dale New on Medford Oreg. 7

**100 LETTERHEADS**, 100 envelopes \$1.00 cash. American, Box 391, Charlotte 1 North Carolina.

**CLASSY** printing economically produced. Quick deliveries. Samples. Bicocan, 6348 Windham, St. Louis 20

**FOR** rich impressive printing reasonably priced. Write Precision Printers, 2101 Fifth Avenue, New York 18, N. Y.

#### PRINTING OUTFITS & SUPPLIES

**PRINTING** Outfits and Supplies. Send stamp for details or dime for complete illustrated supply book. Kelsey Inc. W-8, Meriden, Conn.

**NOW**, you can make your own printing cuts by simple easy Pasteplate process. No messy chemicals. Dayservice, Argyle, Wisconsin.

**PROFESSIONAL** stencil post card printer, complete \$2.45 postpaid. Challenge Association, D-12, Cincinnati.

**INEXPENSIVE** home made printing press. Details free. Novelty Shop, Downsville, Louisiana

**PRINTING** Presses, Type, Supplies, Lists 3c Turnbaugh Service, Loyale, Pa.

**PRINTER & Supply** Bargain Catalog Send stamp Bradshaw 1214 Huron, Chicago 34

**PRESSES**, type supplies, paper, List 3c, Levinson Box 918 New York 8

#### PROFITABLE OCCUPATIONS

**MECHANICALLY** Inclined Man—Own and operate general Appliance Repair shop. Complete illustrated course shows you how Welding Refrigeration, Motor repair. How to get business, etc. all phases covered. Free literature. Christy Supply Dept. 1008 2813 N. Central Ave. Chicago

**OPERATE** your own Refrigeration Repair Shop. Good jobs now and after the war. Easily learned at home. Common education sufficient. Free booklet. Mechanics School Dept. B-20, 4701 West Pine Los Angeles 6

**LOCKSMITHING** Course—Practical, inexpensive lessons for handy men. Just out! Fil keys pick locks, de code make master keys. Refurbish on guaranteed. Send for Free Details. Nelson Co. Dept. 709 Chicago

**\$40.00 WEEKLY** Made growing mushrooms. Fresh Dried. Dominican Fruit 33183, Free spawn, North American, 180Y Yonge Toronto Canada

**\$5000 FROM Half Acre!** Growing Ginseng. Seed contract supplied. Particulars 10c. Associated Growers, Dept. 11, St. Norbert, Manitoba

**RAISE** highly profitable angora rabbits. Multiply fast. Wool \$8.50 pound. Plenty markets. Particulars free. White's Rabbitry Marion Ohio

**CLEAN** Up building Plastic Houses. More money than you ever dreamed of. Build your own, Build for others. Details free. Plastic Box 872, Wilmington California

**OPERATE** newspaper clipping bureau. Steady paying home business. Fascinating rewriting work. R. H. Madisonville, Cincinnati 27

**OROW** Mushrooms in boxes. Instructions 25c. Spawn \$1.00. Gordon, 543 William, Winnipeg Man

#### RADIO, SUPPLIES & INSTRUCTION

**RADIO** Interference causes. What they are, where they are, where they come from and how to prevent them explained in new copyrighted booklet. Radio Listener's Guide. Written in plain language by interference expert. Fifteen years in the field. 8 00 Postpaid. A. E. Rowe & Co. Inc. Dept. 8, 440 Mission Street, San Francisco 5 Calif

**RADIO** Service Men and experimenters send for our giant radio catalogue. Set 6 dollars. United Radio Co. (1000-V), Newark N. J.

**REVISED** Plasma 18 Crys. & Sets (5W record 5000 miles) with Radiobuilder 25c. Laboratories, 363-T Hampton, Hayward, California

**LOWEST** Prices, Radio Tubes, Parts, Free Bargain List. Potter, 1314-A McOee, Kansas City Mo

**RADIO** repairing with actual 4 part 11 page booklet 25c. Supreme Publications 128 S. Jefferson Chicago

**CRYSTAL** Radio Experimenters. Write. Hulet 29 E 39th New York

#### RARE COINS

**FREE** Foreign coin, banknote and Coin Collectors Illustrated Catalog to approval service applicants. Send 3c postage. Up to \$20 cash paid for Indian head cent's. All dates wanted. Buying List 10c. Tatham, Colton, Springfield D59, Mass.

**COIN** Collectors—Read "The Numismaticist" Published monthly. News, illustrated feature articles on coins and medals. Sample copy 25c. American Numismatic Association, 99 Livingston St., Brooklyn 2 N. Y.

**WILL** Pay \$10.00 each for certain Lincoln Pennies! Indian heads \$30.00. Dimes \$1.00.00. Catalogue 10c. Federal Coin Exchange 1-PS, Columbus 15, Ohio.

**COMMEMORATIVE** 1/2 Columbia, Texas, York, Elg n Kentucky \$1.50 each. Illustrated catalogue 10c. Norman Shultz, Salt Lake City 9, Utah.

**COMPLETE** Catalogue of all U. S. coins 1/2c to \$1.00. 15 illustrations. 3500 Quotations. Price 10c. James Randall, 341 South Dearborn, Chicago.

**THREE** different Foreign Coins and Bills and price list all for twenty cents. Ralph Hirschberg, 23 Waverly Avenue, Ocean-side, New York

**WE** purchase all Indianhead pennies. Complete catalogue 10c. Wallman, 390 Broadway, New York.

**FIVE** foreign bills, 25c. Twenty-five different \$1.00. Bessie, Box 37-A, Ottawa, Illinois.

**10 INDIAN** Head cents, different dates, also price lists, 35c. Schultz, 10632, Richmond Cincinnati, Ohio.

**30 DIFFERENT** Foreign Coins \$1. Appraisals De monie 725 W 172 New York 32.

#### RAZOR BLADES, SHAVERS

**TRIM** RITE combs cuts own, others hair. Complete 50c Postpaid. Guaranteed. Agents Wanted. Watson Hanger 734AL Ridge New Kensington Pennsylvania

**ILLUSTRATED** circular Home Hair Trimmer. Kendall Sales, 16 Bulfinch, Boston 14, Mass.

#### RUNNER STAMPS

**3 LINE** stamp 35c, cushioned, indexed, 35c. Signatures \$1.00. Primilla, Wauwatosa, Wis.

**ONE** line 15c, 2 lines 25c, 3 lines 35c, Excellent, Box 508, Shreveport, Louisiana.

**QUALITY** 3 lines 45c. Signatures \$2. Federich Mfg., East Pittsburgh, Pa.

**ONE** Line 15c, 2—25c, 3—35c, 4—45c. De-Lake Stamps, Auburn, Nebr.

#### SCIENTIFIC SUPPLIES

**ILLUSTRATED** charts, Radium, Prisms. Books Research Dept., 3915 Twenty Fourth St., San Francisco.

#### SONGWRITERS

**SONGWRITERS!** B. M. I. Publisher with established Radio Programs seeks new songs, poems! What have you? Professional, accurate examination. Free! High quality recordings made. Transradio Music, Inc. 1440-P Broadway, New York.

**SONGWRITERS** Send your poems for our offer and Free Rhyming Dictionary. Photograph Records made. Vaudeville Music Studios, Box 112, Dept. 5-B, Coney Island, N. Y.

**SONGWRITERS** We are looking for good commercial songs. We pay highest royalties. Write for our publication and distribution proposition. Parson Publishing Co. 343 S. Dearborn St. Chicago 5.

**SONGWRITERS** Melodies supplied without charge by well known Hollywood Composers. Manuscript lead sheets and records furnished. Cinema Song Company, Box 470B-8, Beverly Hills, California

**POEMS** Wanted for Musical Setting. Send poems for immediate consideration. Five Star Music Masters. 444 Beacon Building, Boston

**SONGWRITERS** Send Poem For Immediate Examination and Free Rhyming Dictionary. Richard Brothers, 46 Woods Building, Chicago.

**SONG** Poems Wanted. Write for Free Instructive Booklet, Outlining Opportunities. United Music Corporation, Dept. 26, Salem, Indiana.

**SONGWRITERS** Write for free booklet, Prof. Brang Plan Allied Music Company 304 East Fourth, Cincinnati, Ohio.

**SONGWRITERS!** Outstanding songwriting with re. Roscoe Barnhart, 1370 48th, Des Moines Iowa.

**SONGWRITERS!** Amazing, convincing offer. Kibbler, C-5, 2157 N. Avera, Chicago

**SONG** poems wanted—Write for free booklet, Instructions, Song Service, 331-J West 44th, New York.



**GOOD** Music composed to good words. Music printing. Reginald Belcher, Chatham, New Jersey. Established 1910.

**SONGS:** poems wanted, free publishing, royalties. Song Writers Guild, Box 2230, Hollywood, California.

**SPORTING GOODS, GUNS, FISHING TACKLE, ARCHERY**

**BOWS**—Arrows for Recreation—Hunting—Fishing. Beautiful Archery instruction book, 90 pages, 50 illustrations only 50c. Illustrated catalogue Free. Archery, 417 South State, Chicago.

**USED** Guns, Binoculars, bought, traded, sold. Ammunition bought Highest Cash Prices Paid. Stogger Arms Corp., 507 Fifth Ave., New York, N. Y.

**ARCHERY** Equipment: Catalogue Free. Mid-West Archery, 2209-D East 15th, Chicago 49.

**GUNS**—Blued, Plated, Checked, Refinished. Nickled guns Blued. Bluing Sales. Gunbu, 323 Plant, Tampa, Florida.

**SEND** 10c for list 100 used guns. Frayseth, Willmar, Minnesota.

**USED** guns, bought, sold, exchanged. List stamp. Howe, Coopers Mills, Maine.

### STAMP COLLECTING

**1943 PAGES** in Review! Breath-taking Events in our 137 different suggestive Values as Allied African Victories, magnificent Free French, Reich 24 hour Bombing German Pictorials, Ukraine's recaptured Breadbasket, Russian Mints, Mussolini's Flight and Italy's Capitulation, outstanding Airmail, Aleutian, Solomon and Gilbert Re-occupations, Pacific Issues, Underground Work, French, Belgian, Czech, Dutch, Balkan and Scandinavian Pictorials, Chiang's Victories, typical Japanese Hitler's Eastern Defeat, 18 spectacular Soviets; Big Four Conferences. Vivid Issues and even Russia's striking 1943 Enemy Destruction Issue cataloging \$2.00! to new approval applicants—only 10c! Intercity Co., Dept. Y, Port Washington N.Y.

# POPULAR SCIENCE Opportunities

**NOTICE**—Readers answering ads offering Approvals receive a selection of stamps from which they may make purchases at prices indicated. Ten days are allowed for payment and return of undesired stamps. Otherwise approval applicants become subject to Section 2350, Postal Laws & Regulations, 1932, providing penalties for obtaining property by false pretense.

**WOW!** \$10.00 Worth of Fun for only 10c! 500 Foreign Stamps, unsorted and unpicked (mostly on bits of paper) just as received from the church missions and other sources. Africa, So. America, Australia, China, Philippines, Dutch Indies, and other countries are represented. Includes a few commemoratives, airmails, and stamps cataloging up to 75c or more each! The biggest Package of Fun in Stampdom—and you might find something really valuable! Price only 10c to serious approval applicants. Money back if not delighted. Jamestown Stamp Co., Dept. No. 5, Jamestown, New York.

**FIND** Stamps Worth Fortunes! Six B.c. Items! "Queer Countries" Packet: Djibouti, Quallor, etc. Packet scarce Russia, Catalog price 50c! Fine packet of 25 different British Colonies, Turks & Caicos Islands, Hyderabad, Jamaica, etc. United States \$4.00 and \$5.00 high values. Big "Far East" packet of 20 different stamps from Dutch Indies, Siam, Philippines, etc. Illustrated 32 page booklet—tells where to look for and sell, stamps worth up to \$10.00 apiece! Everything for only 5c to approval service applicants! Mystic Stamp Company, Department 55-R, Camden, N.Y.

**125 ALL** different U. S. \$1.00, Old, new issues—Comma, Postage—Dues Famous Americans—Airmails, etc. Good road, ion Lightly cancelled. Guaranteed to please. Try our foreign packets 10c each, 1 for 25c 14 packets \$1.00. All different. Bargain Approvals sent on request. Armour Stamp Co., 81 Albana, N. Y.

**FREE!** The Stamp Finder! Send today for big new edition, fully illustrated, enabling you instantly to identify all difficult stamps! Also one packet strange, fascinating stamps from Bosnia-Herzegovina, Monaco, Patania, Cyprus, etc., including maps, ships, animals and strange scenes. All free to approval applicants enclosing 3c postage. Garcelon Stamp Co., Box 918, Calais, Maine.

**FREE!** Leeward Is., Cayman Is., Turks and Caicos plus 50 different mint Geo. VI Coronation poster stamps, to approval service applicants sending 3c postage. Tatham Stampco., Springfield 50, Mass.

**POSITIVELY** Greatest Free Offer—Latest Scott's International \$4.00 Stamp Album—covering entire World contains 36,000 illustrated descriptive spaces, Scott's 1944 Standard \$5.00 Catalogues "Philately's Encyclopedia"—absolutely Free to applicants for Foreign Approvals becoming customers. Plymouth A-3, Bell, California.

**INVEST** a 1c postal in writing for "Treasure Island" Gift Offer—giving, entirely free—to purchasing customers of our fine foreign approvals, latest big 1200 page Scott's \$5.00 International Postage Stamp Album (or \$3.00 Loose-leaf); Scott's 1944 \$5.00 catalogue. "Treasure Island" Service, Vista, California.

**WORLD'S** Largest Diamond And Triangle Stamp Free Stamp Magazine, Stamps from Fighting Free French, 26 stamps from 25 different United Nation Countries, Pictorials, Airmails, Big Bargain 5c with approvals Capital Stamps, Dept. 10, Little Rock, Ark.

**EXTRAORDINARY** offer! Dutch Indies, Tunisia, Victoria, Philippines, Estonia, Indo-China, Luxembourg, Ceylon, Mozambique, Transvaal, Algeria, Wurtemberg, New South Wales, Venezuela, Danzig, Newfoundland. Everything only 5c Imperial, Box 30-P New York City 34.

## USE THIS ORDER FORM TO INCREASE YOUR MAIL ORDER BUSINESS!

### LOOK AT THESE LOW RATES

**35c**

Per Word, Per Insertion  
WHITE SPACE—\$2.00 Per Line.  
Minimum Ad—10 Words—\$3.50

**CASH WITH ORDER**

If You Sell A Product or Service To Men, Use This Easy Means To Get More Sales

### CLASSIFIED ADVERTISING ORDER

**POPULAR SCIENCE MONTHLY • 353 FOURTH AVENUE • NEW YORK**

Please insert the ad below in your ..... issue.

Heading.....

Enclosed is \$..... Word Count.....

Name.....

Address.....City & State.....

To be inserted in the next issue, this order must reach us before the 8th of the month.



**SMOXY** Mountain commemorative sheet, largest U S stamp issued and 33 U S. including commemoratives, airmail, revenues, etc. Catalogs 15c—To approval applicants for Dr. Curhan Stamp Company, Dept. C Gloucester Mass.

**BEAT** this! Supreme foreign mixture containing lots of French, British colonies and stamps of entire world, catalogs more than \$25. Everything in this mixture! Price \$1.00 postpaid. International Stamp Co., Hallettsville, Texas.

**FINE** Approvals, freshly mounted, fast, personal service. Tell me what countries you prefer and I'll send their stamps. Milton Skinner, 345 East Ocean, Long Beach 2, Calif.

**127 DIFFERENT** Stamps including Free Fighting French, Haiti, Johore Perak. Only 10c to approval applicants. Reich Stamp Co., 4447 Kenmore Chicago, Dept. 87.

**19TH Century U S Commemorative** C. I. War Revenues, Battleships, \$5 & \$10 Stamps Free to U S. Approval Applicants. Metropolitan Stamps, 198-G Broadway, New York.

**BRITISH Empire Collection!** Burma, Cyprus, Gwa, for Sarawak, Tasmania, Also 50 other British. Only 5c with Pictorial, and Commemorative Approvals. Lyman, 97 Nassau, New York City.

**SPECIAL—Airmails—21** different, including Zeppelin Triangles Latin America etc., 5c with approvals. Continental Stamp Co., Box 808, Dept. C, New Rochelle, New York.

**100 DIFFERENT** including scarce airmail triangle. 3c to approval service applicants. Avalon Stamp Co., Dept. S, Springfield 1 Mass.

**FREE—Your choice** of any 10 stamps from our first U S. Approval section, illustrated list included. Cosmopolitan Stamp Company, 1437 Broadway Dept. 82 N Y C.

**FREE! Complete "United States"** stamp catalog with 1,000 illustrations. Send 3c for postage. Harris & Co. 98 Tremont Building Boston, Mass.

**SOLOMON Islands** Seychelles, Nejd, Caymans, Marshall Islands, Brunei. Everything 3c with approvals. Viking, 130 (P) Clinton St. Brooklyn N Y.

**PHILATOPIC Monthly Free** Forty pages—profusely illustrated. Includes Stamp Encyclopedia. Empire Stamp Company Dept. PR. Toronto Canada.

**UNITED STATES** approvals complete coverage fine quality attractive prices. Bermuda Stamps, Box 435, Coconut Grove, Florida.

**FREE Outfit!** Album, stamps, binder, gauge, detector. Set General foreign approvals sent. Manchester Stamp Company, Manchester, Conn.

**FREE—Canadian Sets** Royal Visit, George VI, George V, Coronation Jubilee Orders, to approval applicants. Ensign Box 118-P 60, Orange, N J.

**25 DIFFERENT Russia** Large Pictorials, Commemoratives and Airmails, attractive issues 50c postpaid. Benjamin Bren, Station A, Box 141 Manchester, Conn.

**FREE premiums** to approval customers. Information sent with first selection. James Vance, Box 1528, Station A, Columbus 1 Ohio.

**FIFTY British Colonies** and twenty U S. Commemoratives for 3c postage to approval applicants. Pan-Am Stamp Co., Box 1166, Miami 7 Florida.

**UNITED STATES** Numbers 182, 219, 220, 270, 381, 384 (Mint) 50c. 637 Send 25c Approvals forwarded. Whiton-Stamps, Norwalk, Connecticut.

**MEXICO Census Commemorative Set** Free with approvals. Platoon Stamps, 1717-S, Idaho, Toledo, Ohio.

**A \$2,000 stamp** plus 50 different, 3c with approvals. O. Knapp, Box 1361, Bristol, Conn.

**WASHINGTON Bi-Centennial** 12 varieties complete 10c. Herman Kleinman, Jenkintown 3 Pennsylvania.

**FREE! Western Hemisphere Packet** Postage 3c. Owens, 801 Washbldg., Baycity, Mich.

**FREE! Pony Express set** (facsimiles). Postage 3c. Roberts, 401 Shearerbldg., Baycity, Mich.

**FREE!!! British Empire Packet** Postage 3c. Williams, 601 Archerbldg., Baycity, Mich.

**FREE Packet!** Interesting price lists. No approvals. Hulet, 29 east 39th, New York City.

**NEWFOUNDLAND** used stamps 40 different, \$1.00. Cecil Paley Englee, Newfoundland.

**LIBERIA C 4 5 10c** with 1, 1, 1c approvals. Carroll's, 163C W. 45th, Los Angeles 37, California.

**AFGHANISTAN** Siberia, Perak, etc., 3c with approvals! Saxon Valley Stream N Y.

**3 DIAMONDS** and Triangles 3c with approvals. Beaman, Glenburnie 10 Maryland.

**50 DIFFERENT** from Fighting Nations—10c Approvals. Liberty Stamp Co. Dept. 8. Kirkwood 21, Missouri.

**FREE Packets—sets** Details with approvals. Thompson, 27 Glenwood Place, East Orange, New Jersey.

**WASHINGTON Bicentennial set** 3c United States and foreign approvals accompany. Yokums, Box 1377 San Antonio 8, Texas.

**U. S. 50** different 3c to Approval Applicants. Neumann & Co. 1506 W. Oklahoma Ave., Milwaukee 7, Wisconsin.

**FREE—New Union South Africa War Set** to Approval Applicants. Charles Ciesla land, 808 North Humphrey, Oak Park, Ill.

**STAMPS** sent on approval, outstanding quality low prices. Fred Herzberg 163 Oak, Elmhurst, Illinois.

**PHILIPPINE Aguinaldo Revolution Set** Catalogs \$1.50—10c. Mayfield, Route Three, Chattanooga 9, Tennessee.

**60 DIFFERENT United States**, incl. Commemoratives. 10c. Pictorial free. Seidenberg Baroda Michigan.

**100 DIFFERENT 10c** with approvals, Jacobson, 140 West 75th Street New York 23 N Y.

**50 DIFFERENT United States 3c** with Approvals. Bookman, Box 145-P Maplewood, N J.

**100 DIFFERENT Airmails \$1.00** 200 25 00. Paltra Company, 2044 Concord, New York 58.

**EXPENSIVE stamps** free. Send dime for details. 15 commemoratives. Fair, Box 180 Bristol Oklahoma.

**BRAZIL Diamond shaped set** 10c with approvals. Vargo Stamps, Racine, Wisconsin.

**1,000 GRABBAGS 15c each** 8 d. Terent 81 Sandy 630 Bingham, Reading Pa.

**BETTER United Stamps Approvals—Choice** Wide Selections—Box 438A. Minneapolis.

**10 SIAM only 3c!** Approvals, Ryan, Pine Street, Middletown, Conn.

**FIFTY Stamps** for 3c with approvals. Stanley Gardner, Salyersville K.

**1000 MIXED U S. Old and New 25c 2 lbs.** \$1.00. Weatherby, Troy, Ohio.

**U S. COMMEMORATIVES** good 100 different 65c. Meitzen, Fayetteville, Texas.

**100 ALL different U S. 10c** Monjar, 1730 Fairmount, Cincinnati Ohio.

**25 DIFFERENT Canada** free. Streiner, 1030 East 61 Cleveland, Ohio.

**10 FINE U S. 1863—1903** 03c. Weston, Box 20, Oklahoma City, Oklahoma.

**RARE Grabbags 15c each** Approvals. Lealle, Box 31, Magnolia, Arkansas.

**PENNY Approvals** that satisfy Neil Oronberg, Box 54419, Philadelphia 43, Penn.

**TRY my 1c Approvals** Chick, 712 High St., Bath, Maine.

## TOBACCO—PIPES

**ONE pound** of mellow pipe cut tobacco. A blend of Perique, Maryland, Havana, Virgin a. Cavendish and Burley. Cool and delicious tasting mixture. Exceptionally mild. Only \$1.25. Send for free Catalog and trial offer. Sidney Ram 58 West Monroe, V-4, Chicago 3, Illinois.

**35 AND 54 leftovers** of blended smoking tobacco. Only \$1.75 per pound. Send for Free catalog and trial offer. Sidney Ram 58 West Monroe Dept. K 4 Chicago 3, Ill.

**PIPE Buri**, Manzhett, blocked, and bored. Postpaid \$1.00. Finish yourself, write for quantity price. Pap the Piper, San Jose, California.

## TRAPPING

**FOXES** Nine in one day. Trap all fur-bearing. Particulars Free. Guaranteed. Write—Estabrook, Sharburne, Vermont.

**ELEVEN good Box Traps** Complete blueprints, 30c. Wee-Sho-You, Box 61, Detroit, Mich.

## TREASURE FINDERS

**MT SCOPE Metal Locator** fully guaranteed and unsurpassed in efficiency. Time payment plan, trade-in and accessories. Free literature. Fisher Research Laboratory Palo Alto Calif.

**BURIED Treasures** and lost mines—over 200 locations in United States. Learn where, information free. Write Treasure Trove, Box 346-G Springfield, Ark.

**SEEK Buried Treasure** Methods, mysteries, devices explained. Circulate free. Century Press Box 151D Glen Ellyn Ill.

## WANTED—MISCELLANEOUS

**SECURITIES**—defaulted railroads, cities, corporations etc. Old or recent, worth less. Send full description for offer. H T Weber 413-P Walnut St. Danville Illinois.

**CASH** For Bicycle Engines, Scooters, Motorcycles, Outboards, Gasol & E. Engines. Exc. prices. Describe & quote price. Clymer Los Angeles 4 Calif.

**MANUFACTURERS** Agent wants additional lines for jobs and distributors in Montana, Wyoming, Idaho. Write John Messelt 428 Alderson, Billings, Montana.

**ACCORDION**—any condition. Give description, price, Chaston, 600 Blue Island, Chicago.

**MERCURY**—We pay \$2.00 per pound. Free Containers. Mercury Terminal, Norwood, Mass.

**MERCURY (Quicksilver)** we pay \$1.50 per pound. Western Metal Co., Bloomington, Illinois.

## WELDING, SOLDERING

**NEW model electric welder** 110 volt AC-DC, will weld all metals, easy to use, full directions. Complete with power unit, flame and metallic arc attachments, carbons. Takes rods, crack all for \$19.95—Used by the Navy. Marvel Electric Welder Mfg. Co., 195 8P Centre St. New York City.

**BUILD d.c. arc welder** without rewinding a motor. Plans \$1.00 each. 25 to 600 amperes from vehicle motors. Light plant generators, Automobile & trailer generators. Welders Club WB 3412 M. Mart Chicago 34.

**ARC Welder**—build it yourself—costs less than \$1.00. Use available scrap. Guaranteed. No toy. Information free. Write Inisco Corporation, 4347 Parnell, Chicago, Illinois.

**SHORT Of Gasoline?** Make your own gas from water and wood, coal or coke. Operate engines at fraction of usual cost. Complete instructions \$2. Matthews Mfg Co., PBM, Calgary, Canada.

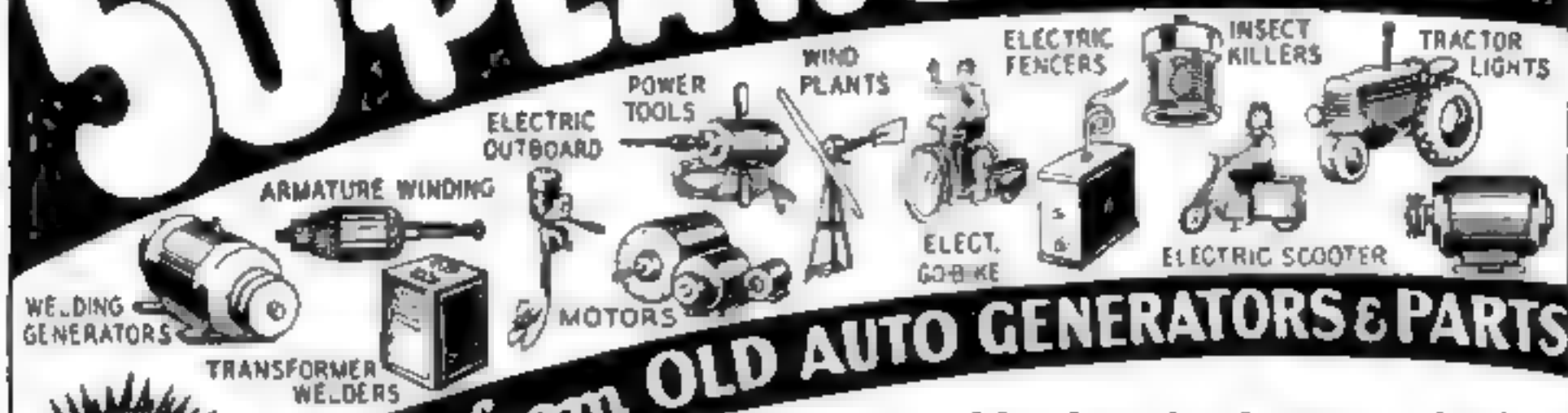
**WELD** Cut, Brake with gasoline! New discovery. Make your own torch. Instructions one American dollar. Matthews Mfg Co., Calgary Canada.

**SLIGHTLY used Arc Welders**, Recommended by R. E. A. Guaranteed. Forney Mfg. Company, Ft. Collins, Colorado.



Worth  
\$1235 IF  
PLANS BOUGHT  
INDIVIDUALLY

# 50 Money Making PLANS Now Only \$150



**Build from OLD AUTO GENERATORS & PARTS**

**Mechanical Knowledge is in Great Demand. Let this Manual Help You to Learn How to Earn.**

Welding—one of the most important of mechanical processes—is covered very thoroughly in the LeJay Manual, which gives you all the necessary information for making welding equipment of different types. It also shows you how to make your own power tools, generators, motors and wind plants for cheap power.

## NO SPECIAL TOOLS OR EXPERIENCE NEEDED

You gain experience as you work with material to be found around garages, workshops and old autos. The younger generation can have lots of fun making the electric scooter or the electric bike pusher, as well as in equipping the camp or cottage with electric power. There are over a hundred ideas on which you can save or make money.

You will find the LeJay Manual of special value in these tough times, when electrical equipment and repair parts—let alone expert assistance—are hard to get. It will show you how to "do it yourself" with the material available. It will enable you to save money on your own jobs and to make money on jobs you can do for others. Since the first edition of this manual thousands have testified to its wonderful value.

## SEND NO MONEY

Fill in the coupon with your name and address and it will bring you the complete LeJay Manual of over 100 build-your-own items. We will send it C.O.D. and the postman will deliver it to your door. If not entirely satisfied after 3 days, send it back and your money will be returned. If you prefer to save C.O.D. fees, send \$1.50 now; same guarantee.

**GET this Book**

It shows you how to Make:

200 Amp. Generator Welders	Electric Fencers
Large Transformer Welders	Electric Drills
Brushless & Carbon Welder	Beach Grinders
Workshop Spot Welder	Armature Rewinding
6, 12, 32, 110-Volt Motors	Electric Scooter
Electric Outboard Motors	Insect Electrocuters
Wind-Drive Light Plant	Electric Bicycle Pusher
and Many Other Things	

**3 DAYS TRIAL**

**LEJAY MFG.CO.**

23 LeJay Building

**MINNEAPOLIS, MINNESOTA**

**MAIL Coupon NOW WITH ONLY \$1.50**

**LEJAY MANUAL**

LEJAY MANUFACTURING CO.,  
23 LeJay Building, Minneapolis 8, Minn.

Gentlemen: Please send me C.O.D. your big 1944 LeJay Manual on the understanding that if after 3 days trial I should return the Manual, you guarantee to return the \$1.50 purchase price. ☐

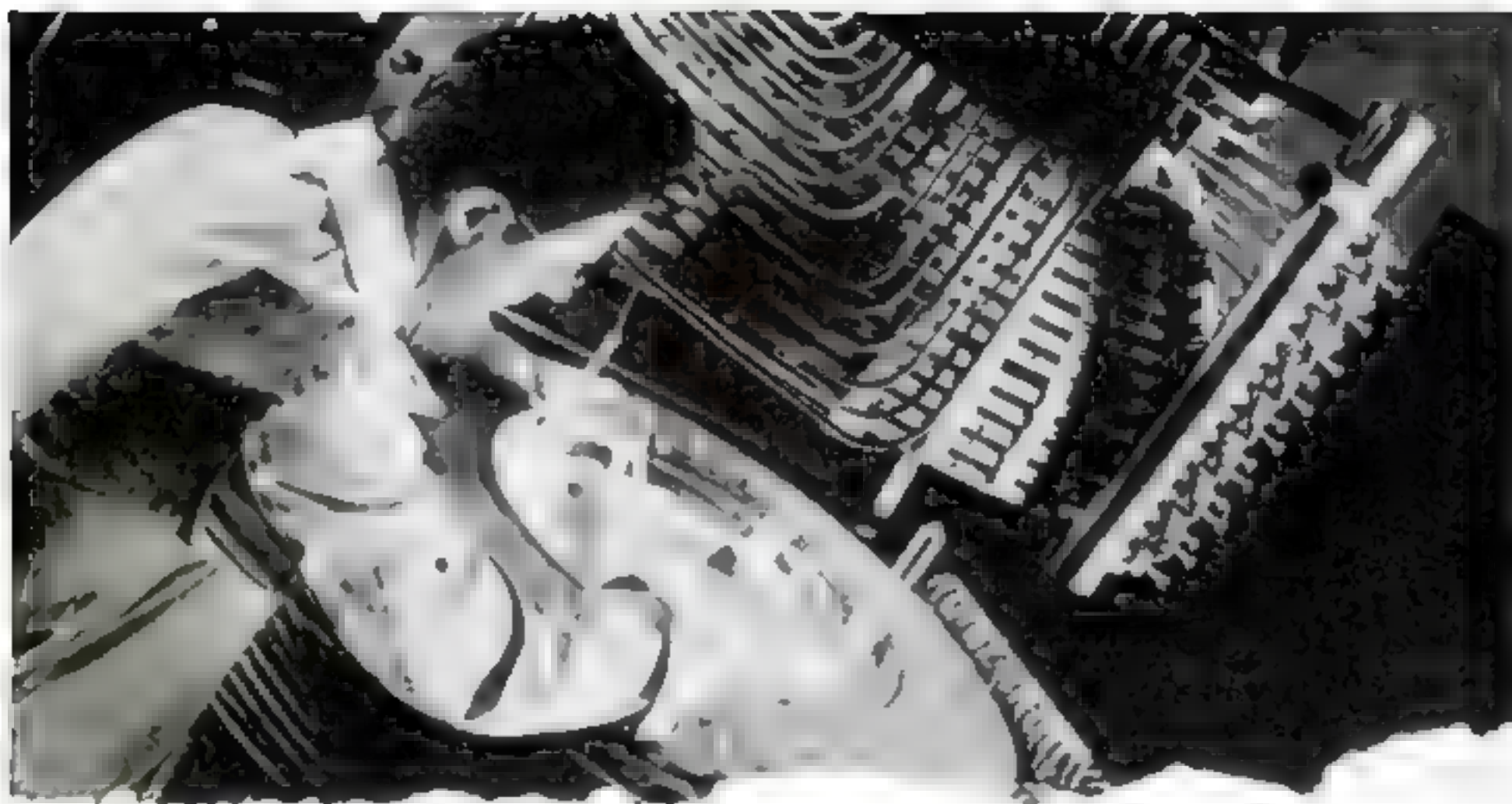
I enclose \$1.50 for the above Manual, same guarantee

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_





Helping the tire maker: Pictured here is a laboratory model of the new Westinghouse-developed "mass spectrometer," an adaptation of which analyzes gases with incredible swiftness and accuracy. Right now, one of the most important of its many uses is speeding up tremendously a step in the making of synthetic rubber.

## **Westinghouse research accepts every wartime challenge . . .**

Under the spur of war, Westinghouse research is delving into numberless mysteries, not only in the vast field of electricity and electronics, but also in chemistry, physics, metallurgy, plastics. And as a result, out of the great Westinghouse laboratories has come a steady stream of new war products, and new and better ways of making old ones.

## **Westinghouse research develops new talent for America . . .**

To Westinghouse, each year, come several hundred budding scientists and engineers—to work, to learn, to blaze new trails in electrical research. And each year, through more than 100 Westinghouse scholarships, young men enter America's engineering colleges to develop the native skill and talent that have made America great and will make it greater.



## **Westinghouse research promises new wonders for peace . . .**

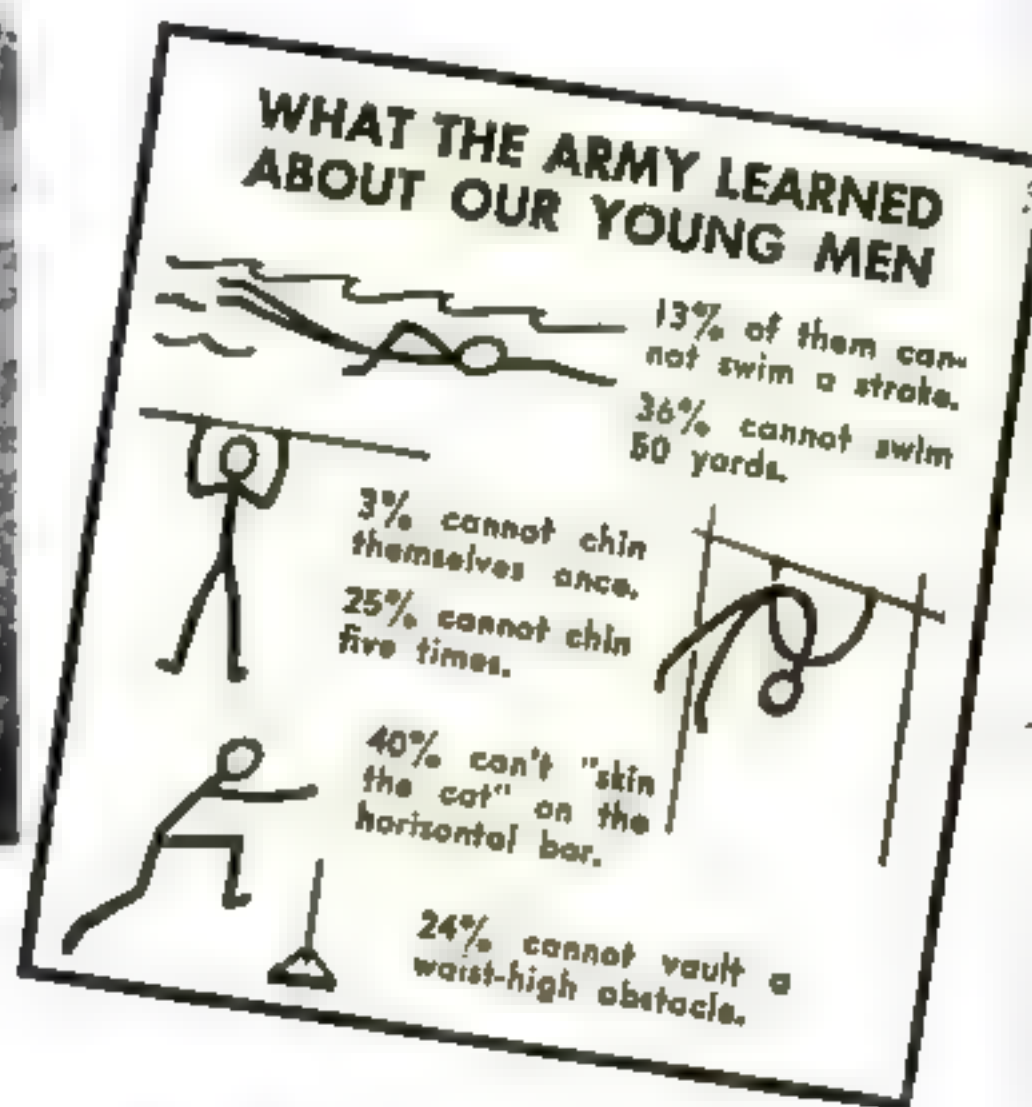
You have heard much talk of the marvels science will offer you after the War. Well, there will be marvels—plenty of them—and Westinghouse research is working to contribute its full share. But we will never lose sight of what we consider our first duty: seeing that, beyond all question, each Westinghouse product, old or new, is the very finest of its kind. Westinghouse Electric & Manufacturing Co., Pittsburgh, Penna. Plants in 25 cities, offices everywhere.







**GUERRILLA TACTICS** are important to every soldier, who never knows when he may find himself unarmed and face to face with a Nazi or a Jap. The man at far left is executing a quick maneuver that will spin his opponent around so that he can grapple with him from the rear, or trip him and throw him hard to the ground



# Can We Make Our Soldiers Tough Enough?

When the Army found that our boys were a bunch of softies, it developed a physical-training program that prepares them in double-quick time for the rough-and-tumble business of war.

By **ALLEN RAYMOND**

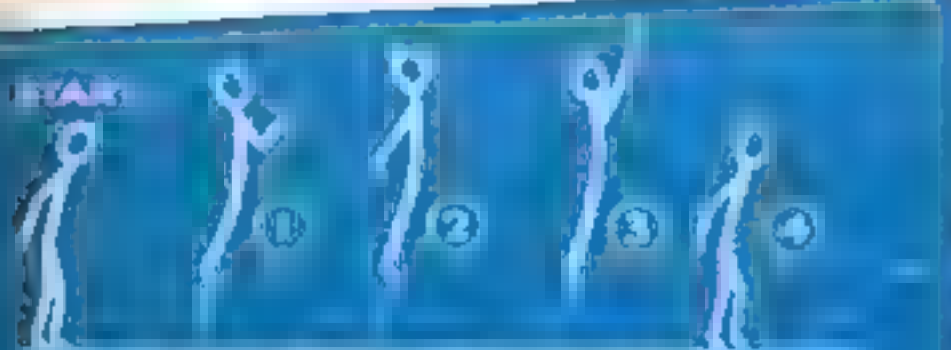
Photographs by **WILLIAM W. MORRIS**

**W**ORLD WAR II demands physical stamina far greater than that possessed by the average American boy. Our young men are a sad commentary on the machine age, easy schooling, and easy living. They're softies, compared with their fathers of a generation ago. They look all right; they're taller, heavier, better nourished, and freer from disease. But they haven't exercised as much as their fathers used to, and they're physical weaklings by present-day military standards.

That's the conviction of the three men largely responsible for the U.S. Army's toughening program. These men, now assigned to the Special Service Forces, are Col. Theodore P. *(Continued on page 60)*



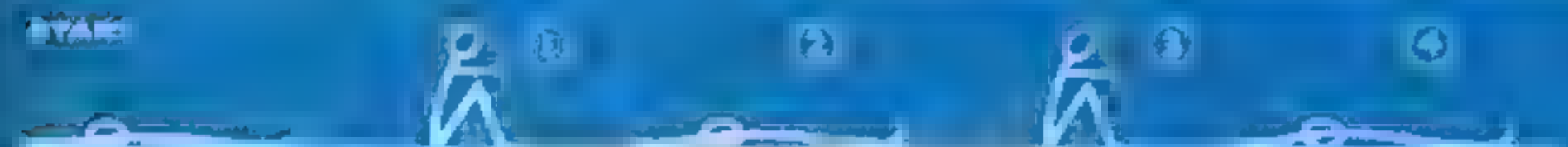
# The Army's Daily Dozen



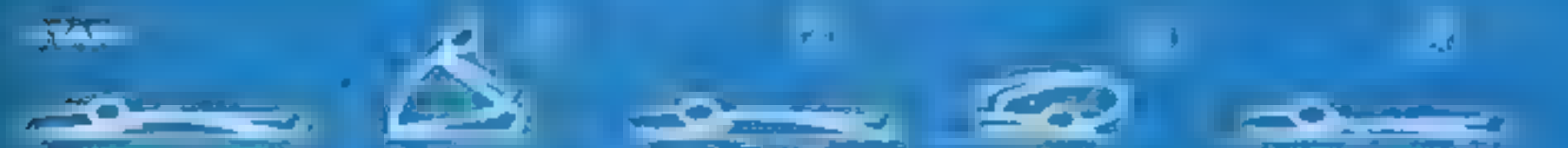
THE HIGH JUMPER



SQUAT BENDER



ROWING EXERCISE



SIT-UPS



PUSH-UPS



**THE BURPEE** is done in four counts. A man first assumes a standing position, with arms at his sides, and feet a couple of inches apart. At the count of "one," he goes down to a squatting position, with hands flat on the ground, and arms inside his knees. At "two," he throws

**THE BANK TWIST**, named after Col. T. P. Bank, one of the three men largely responsible for developing the new physical-conditioning program is a real toughy. A man lies on his back with his legs held up in front of him so that they form a 90-degree angle with his torso. His legs are together, and held straight so that there is no bend in the knees. His arms are extended at his sides, palms down. At the count of "one," he lowers his





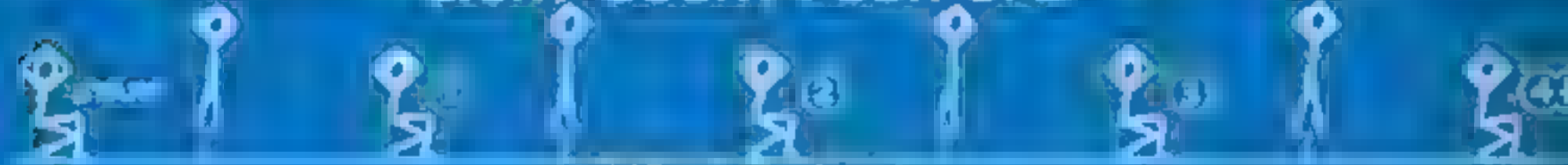
his weight is resting on his hands and toes. At "three," he jumps back to squatting position, and at "four" he stands up. The burpee is one of the seven exercises now being used to test a soldier's physical fitness as well as his improvement under the new toughening-up program. Even the rawest recruit can do this exercise a few times—slowly. But the Army doesn't consider him fit for the rigors of war until he can do it 40 or 50 times, in easy rhythm without pausing for rest. In testing men with this exercise the Army considers that eight burpees done in 20 seconds is poor, 10 burpees is fair, 12 is good, and 13 or better is excellent.



**SIDE BENDER**



**EIGHT COUNT PUSH-UPS**



**SQUAT JUMP**

legs, still held straight, to the ground so that his feet are in the vicinity of his right hand. At "two," he brings his legs back to the erect position. At "three" he lowers his legs to the ground at his left, and then comes up again on "four." Thirty of these twists done fast is considered only average.



**STATIONARY RUN**



**TRUNK TWISTER**



**WEAK HORSE** is one of the Army's toughening-up games. One team lines up, as shown, against "base" at right. Each member of "up" team then takes a flying leap and lands on the backs and necks of "down" team in effort to snap "horse's" back. Below, a page from the games manual now being issued by Special Service



WEAK HORSE ROUND



**Players** Any number  
**Equipment** Belt or taped cloth that can be used as a booster  
**Area** Any area  
**The Game** All players except one form a circle facing counter clockwise with their hands behind their backs heads and eyes to the front. The extra player is given the booster and walking around the circle clockwise places the booster in the hand of another player. The player receiving the booster sends the player ahead of him and chooses his own place to get him as often as possible until he gets back in his starting place. The player holding the booster then gives it to some one else. When the extra player sends the booster to another player he steps into the place vacated. This game can be varied by having the players form a circle facing the center, and when they step they keep their heads behind them. In this variation the player receiving the booster sends the player to his right

once, and more than 25 percent couldn't chin themselves five times. About 24 percent couldn't vault an obstacle waist high; more than 40 percent couldn't 'skin the cat,' an easy stunt for their fathers."

Captain Eslinger had examples—taken from battle reports—to illustrate how disastrous it may be to a soldier in wartime to lack strength in his arms and shoulders. "The crew of an American bomber," he said, "made a forced landing at sea off the Aleutians. A small naval vessel sped to their rescue. With high seas running, ropes were lowered to the airmen floating aboard their collapsible raft. All but one were saved. That man couldn't climb the rope."

A similar fatality occurred, he said, aboard a U.S. Army transport sunk off-shore in operations near Guadalcanal. An enlisted man was caught below decks with no means of escape except through a hatchway only 20 feet above his head. A comrade tossed him a rope. But the man was unable to climb it, and his comrade was unable to pull him up.

As for strength and agility needed in hand-to-hand combat against such toughened troops as the Nazis, no powers are too great. It was with such situations in mind that the three university athletic directors went over scores of standard drills in calisthenics to develop the single set of 12 that is now working miracles for the Army. They packed into a dozen basic exercises, which can be run through in 20 minutes, more strenuous physical drill than was contained in the 60-minute system used before the war. Then they added "guerrilla" exercises and combative drills, and topped their new system with rough-and-tumble games to build competitive spirit among our troops.

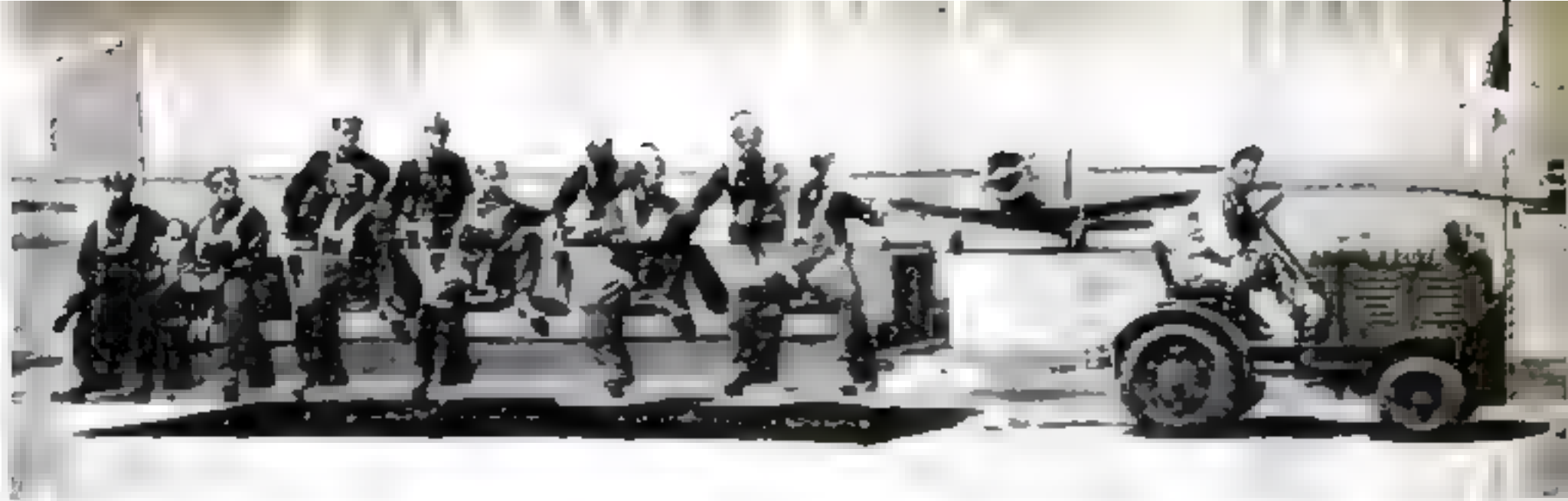
Under the new program, recently compiled in a manual known as Training Circular 87, every soldier in our Army must be tested individually (Continued on page 203)

Bank, formerly athletic coach at Tulane and Idaho universities; Capt. A. A. Eslinger, director of physical education at Leland Stanford University, and C. H. McCloy, director of physical education at the University of Iowa. Much of the new training system was worked out by this trio just before Pearl Harbor.

At the school in Washington and Lee University, Lexington, Va., where Special Service officers are trained in the new hardening program, Captain Eslinger gave me some data on the physical unfitness of average American college boys, as of 1940 and 1941.

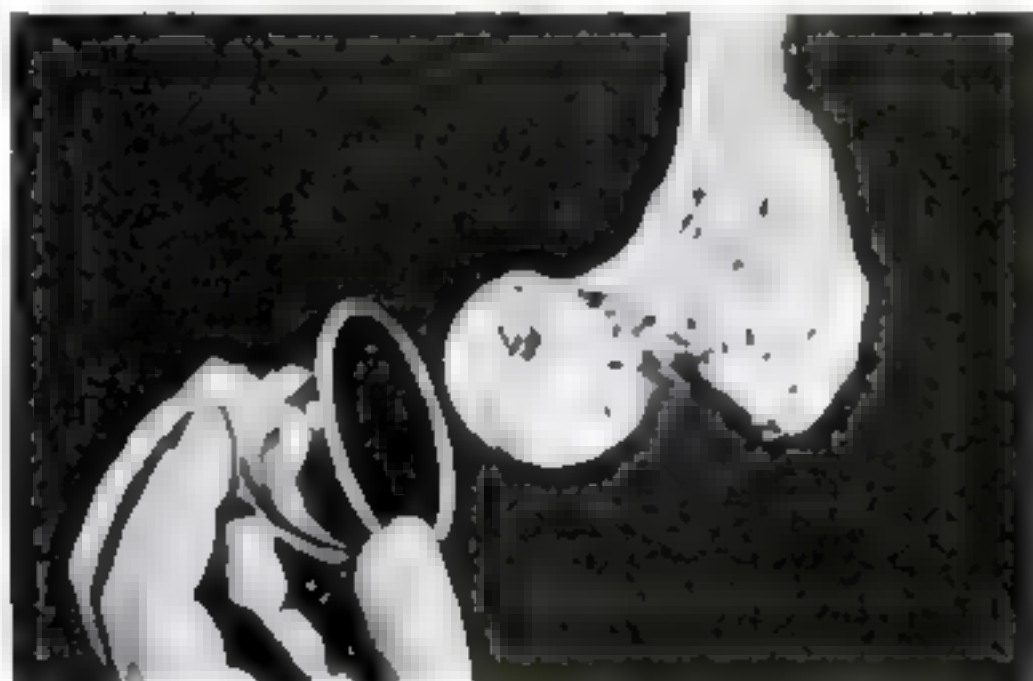
"In a physical-fitness test of 1,000 men at the University of Illinois in 1940," he said, "the following facts were revealed: 13 percent of them couldn't swim a stroke and 36 percent couldn't swim 50 yards. Over three percent couldn't chin themselves even





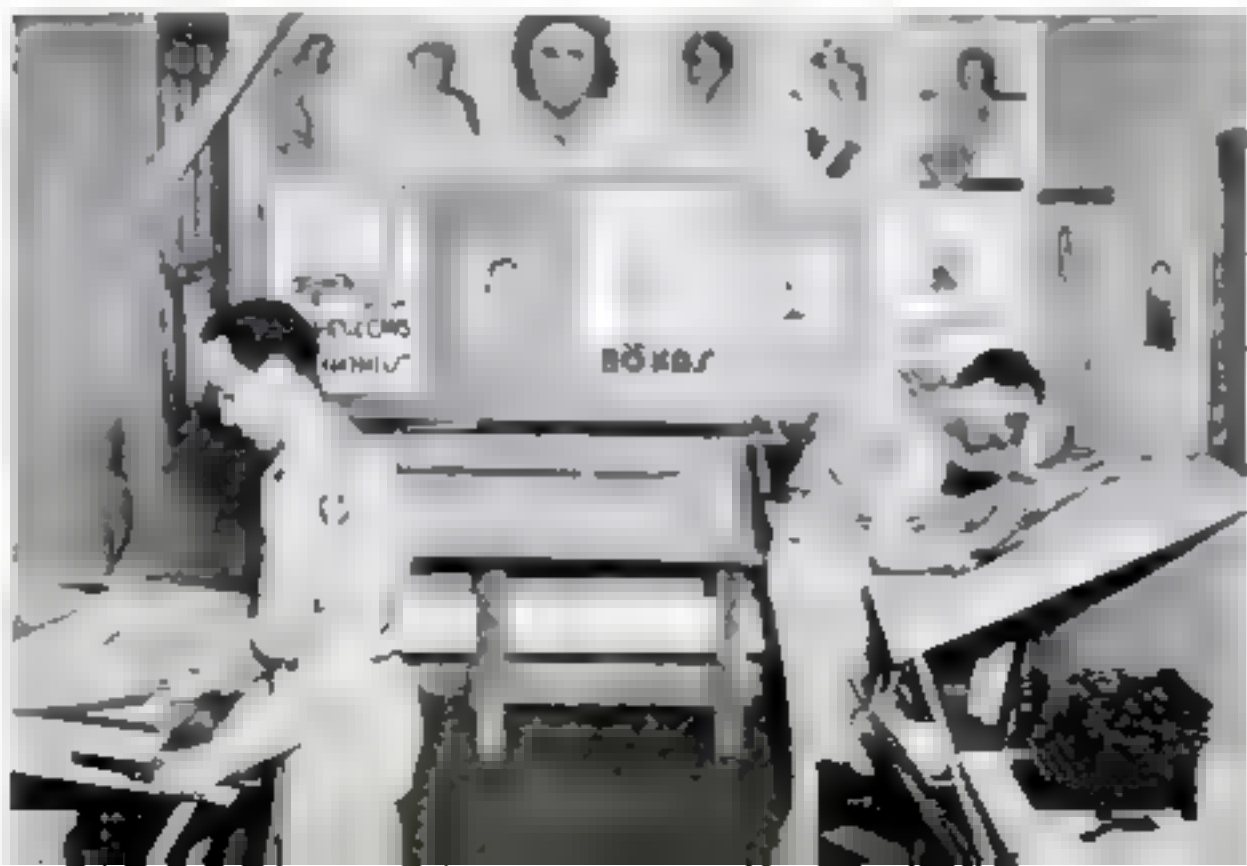
**THE "DRIP,"** designed and named by Col. K. C. McGregor, is used by the Army Air Forces Western Flying Training Command to taxi flyers and their equipment to and

from their planes at the Basic Training School at Gardner Field, Taft, Calif. Looking like a movable "bleacher section," it is drawn by a "tug" and holds 30 men,



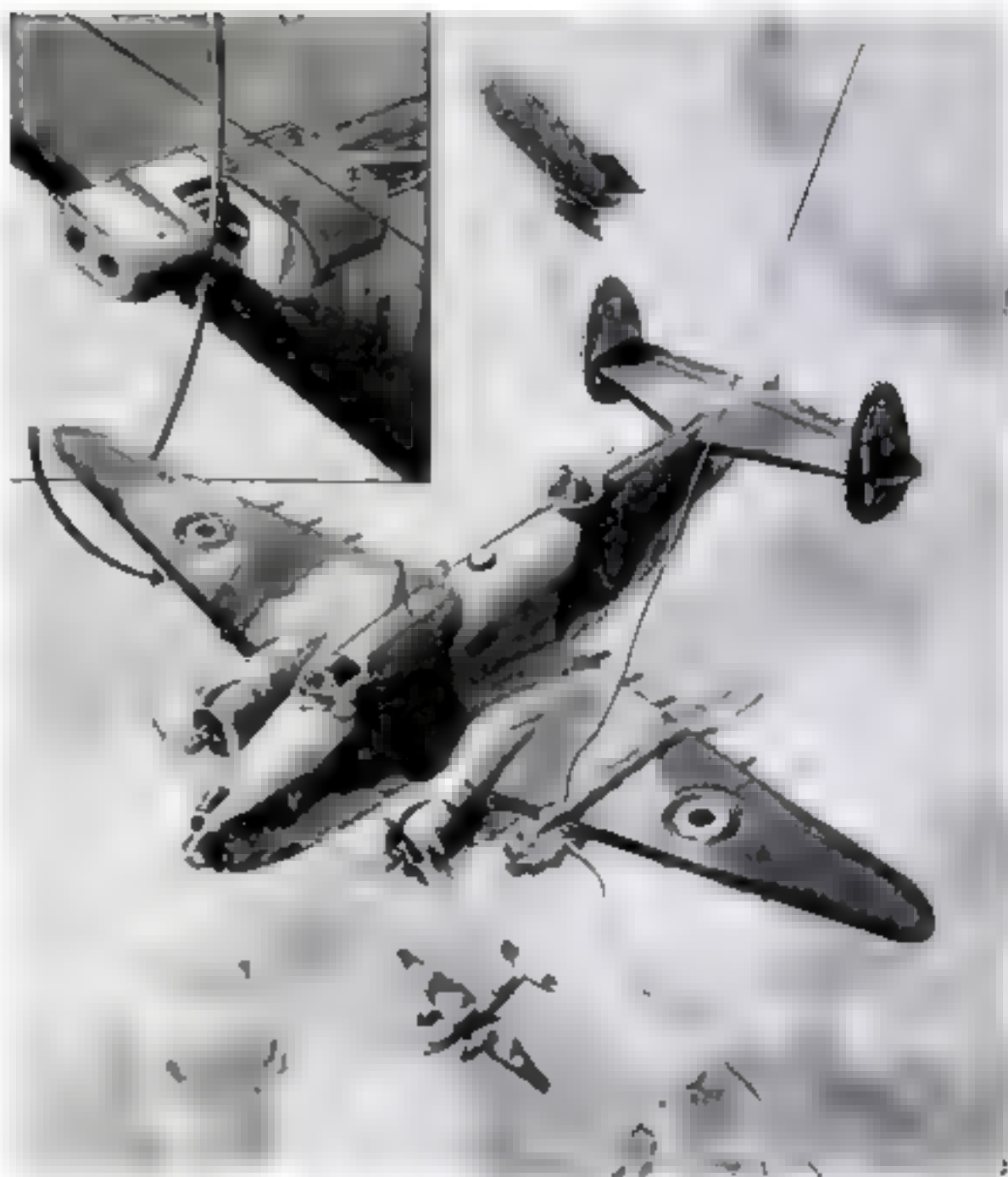
**PLEXIGLAS CUPS,** formed of the same material that is employed to make bomber noses and gun turrets, are being used to restore painless motion in arthritic joints. Besides affording a smooth surface against which the other bones of the joint can move, the transparent plastic cups facilitate subsequent X-ray examination of the bone head from which excess growth—the cause of arthritic pain—has been removed. The cups, successfully used in finger, jaw, and hip joints, were developed by Dr. Paul H. Harmon, surgeon at the Robert Packer Hospital, Sayre, Pa.

**HOBBY CLUBS,** tentatively organized by Capt. Wayne E. Scrivner as morale builders for the men at the U. S. A. A. F. Flying Training Command's Basic Training School at Cochran, Ga., are paying double dividends. Over 200 men quickly responded to the Captain's invitation to get together in photography, woodworking, art, printing, and radio and model-plane building, and the products of their work are now being used by the rest of the camp. The radio club (right) now services all the sets on the post; the model-building club (lower right) provides a place for aircraft-construction experiments; the woodworkers build chairs, tables, and bookshelves for the recreation rooms, and the camp's artists (below) knock out war-bond posters.





**CABLE CUTTERS.** Automatic devices set at intervals along the leading wing edges of Britain's bombers (see inset) are enabling the planes to cut their way through the barrage-balloon cables that the Germans are employing as protection against low-level attacks. When one of the cutters is hit by a cable, the contact sets off an explosive charge. This drives home a chisel that snips the cable. Metal reinforcements protect the wings as the cables slide along the leading edges to enter the aperture of a cutter. The drawing at the right depicts an American-built Ventura, a medium bomber used by the British, equipped with the new device and slicing a path through a screen of German cables. Extending from the trailing edges are the ends of the tracks upon which the Fowler flaps are extended to reduce the speed of the plane in landing.



Drawings by E. G. SEIELSTAD



**VANISHING BRIDGE.** Believed to be the only one of its kind is the Shatt-el-Arab River bridge in Iraq, whose center span sinks into the river low enough for water traffic to pass over it. This unusual design was decided upon by an Indian Army engineer as the best method of eliminating the high towers required by a lift bridge, which would have been constantly threatened by the monsoon gales. The bridge carries both rail and road traffic across the stream, which is formed by the confluence of the Tigris and Euphrates rivers. Its 92-foot center span, which weighs about 35 tons, is raised and lowered by hand-operated winches. At the left is our artist's conception of how the bridge appears with the center span lowered. The span can be dropped enough to be cleared by the deepest-draft boats on the river.



Take it from a Yankee pilot . . .

# Burma Is No Paradise

An interview with

**COL. ROBERT L. SCOTT, Jr.,**

Author of "God Is My Co-Pilot"

By Robert E. Martin

**B**URMA once again may become a battleground of this war. Already it has been the scene of a great campaign, where American, British, and Chinese alike faced hardships and privations beyond what they had to endure from the Japs. Among the Allied fighters was Col. Robert L. Scott, Jr., former Fighter Commander of the China Air Task Force under General Chennault. Because he knows Burma, and neighboring China, as few soldiers do, Colonel Scott has much to tell of the grim business of survival in a land once considered plentiful.

"Before the war, Burma was an enormous rice bowl," said Colonel Scott, "and yet, during May and June of 1942, the Ferry Command dropped 2,000,000 pounds of rice in the northern part of the country to keep two Chinese armies from starving to death. More rice was grown in the Irrawaddy Valley than in any other section of the world, but the Burmese weren't furnishing any food for the Allies.

"As we dropped the rice from about 50 feet, I could see cattle wandering through the streets of villages and out in the fields. I said to myself, 'What the hell is this, anyway? How in the world can those men be starving, with all that food on the hoof available?' So I landed on a little 800-foot airfield to have a look. Then, protected by four sergeants with Tommy guns—not knowing what to expect—I walked down the road and saw plenty of dead men, mostly cholera victims."

The first chance he got, Colonel Scott queried General Ho, who, you remember, commanded those Chinese troops who had come down the Burma Road to support the Allies. Why hadn't he slaughtered the cattle to feed his men?

Jungles, hostile natives, and disease make Kipling's "Road to Mandalay" rough going for both flyers and land fighters.



A "one-man air force," Colonel Scott has flown over every part of Burma, evacuated hundreds of war refugees, and knocked off as many as 1,000 Japs on a single strafing mission.





General Ho, who viewed the situation through the eyes of an Oriental, explained that cattle were sacred in Buddhist Burma, and not a single bullock could be killed, though the people starved by the thousands. Therefore, the only source of food for the Chinese was that which the Ferry Command was able to carry in to them.

"But dropping food, even from a height of only 50 or 60 feet, presents a serious problem," the Colonel went on. "First we dropped 50-pound burlap bags of rice, rock salt, and dried fish. But when the bags struck the ground they immediately burst open, scattering the food in every direction. So we conceived the idea of placing 50-pound parcels of food in burlap bags, each capable of holding 100 pounds. Then we put those bags in others of equal size. On landing, the inner bag burst, but not the outer one.

"We also dropped wooden boxes of ammunition, which we thought was all right because the boxes didn't break. But the impact flattened out the shells so that they couldn't be used. The only way to drop ammunition is with parachutes. Dropping food and ammunition to beleaguered troops

is often vital, but you have to know how to do it. Living and fighting in China and Burma constantly present problems for which there are no answers in the books."

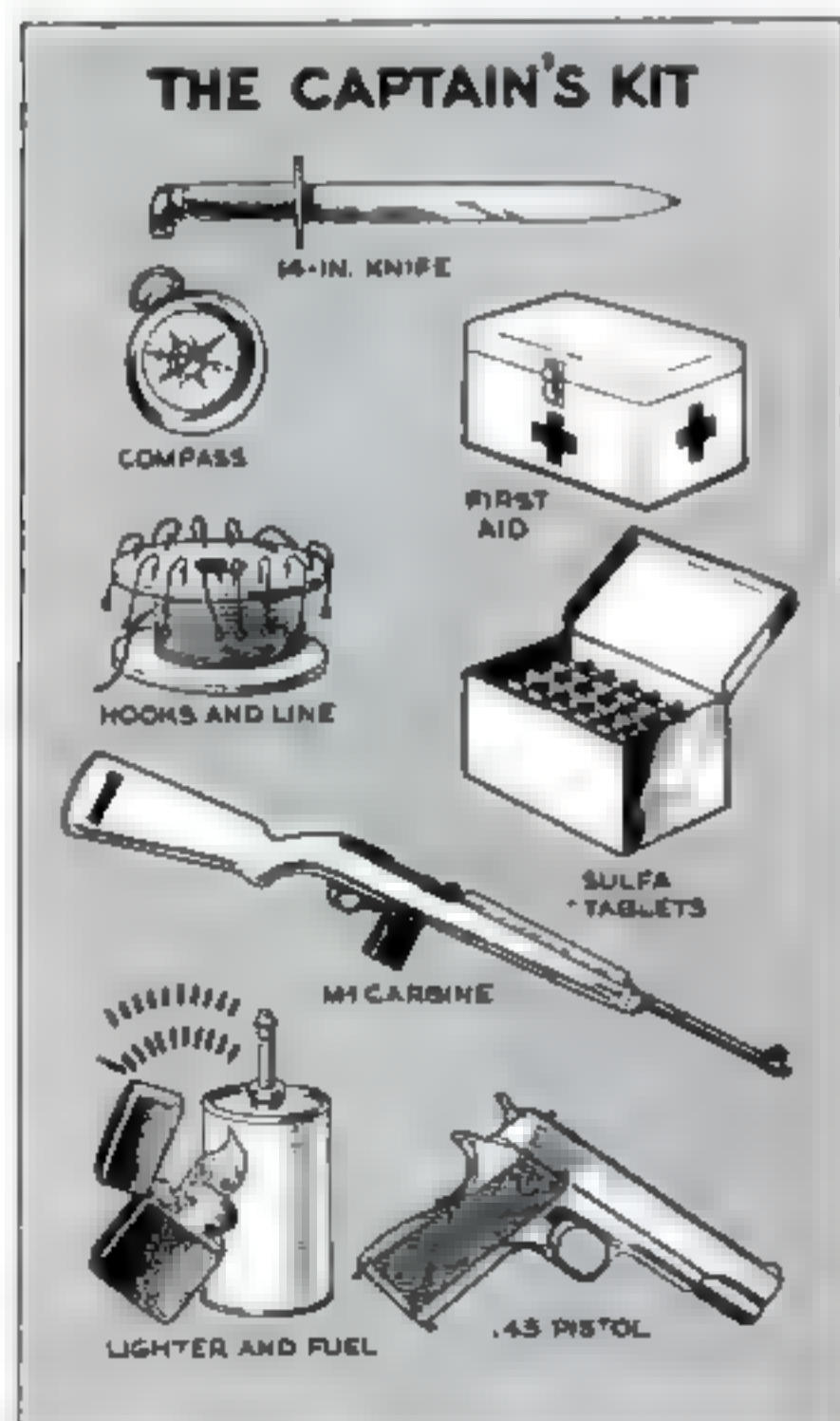
Burma, once known romantically to Americans from Kipling's "Road to Mandalay," is a country of alternating plenty and starvation, distrust and hatred of the white man, disease and superstition, high mountains, thick jungles, and rivers—which, in the rainy seasons, rise suddenly and flood the valleys.

"In China," the Colonel went on, "the people would give you their last grain of rice if you needed it, but in Burma they would plot to kill you while you were a guest in their villages. Waging war in a hostile, disease-ridden land, against an unscrupulous enemy, with your lines of communication from the United States 10,000 miles long, is an enormous problem. But for the individual flyer, the problem is far worse if he has the misfortune to be forced down. He has to face native hostility, religious prejudices, and epidemic disease. Besides, in the jungles of northern Burma in particular, there is very little in the way of food or game on which to live. From the standpoint of survival, it is perhaps the most difficult land in the world."

Colonel Scott knows whereof he speaks, because he has flown over every part of Burma and come in contact with all kinds of people while transporting starving, sick, and wounded refugees by the hundreds from Burma to India. He has been called "the one-man air force," having disposed of from 600 to 1,000 Japs during one strafing mission on a group of Japanese barges and accounted for as many more in shooting up a train in upper Burma. These are but two of many single-handed exploits.

The Colonel, however, is considerably more than a soldier and flyer whose work in China has established his reputation. He has, in addition, a scientific turn of mind, and his observations on geography, climatology, Burmese ethnology (the study of the characteristics of the people), zoology, and botany are worth listening to. All these subjects and more are discussed in Colonel Scott's book, "God Is My Co-Pilot," published by Scribners and now being made into a movie by Warner Brothers.

"I have survived for weeks at a time," the Colonel continued, "in the jungles of South America and among the head-hunters in the forests of Darien, without any serious trouble. I have made my own fire, boy-scout fashion, and cooked my own meals as I found edible plants and game. In fact, no training that I have had in the past has helped me more than having been a boy scout, in making my way alone and living





# Warrior Album



Like a conquering hero a wounded American flyer lucky enough to be forced down among friendly natives is carried back to safety on the shoulders of his rescuers. Burma's head-hunters, however, have to be given a bounty of \$30 for every American rescued with head intact



Disease is rampant among the vitamin-starved natives of Burma, where a fungus growth may eat a hole in a man's leg the size of a baseball. Above, an American-trained native nurse treats a Burmese who wears the traditional head-hunter's hat



Under the watchful eye of a Negro sergeant of the U. S. Army Engineers, Chinese coolies work on a new road to link Assam with the original Burma Road. Completion of the new highway will aid forthcoming Allied offensives



American jeeps and trucks slog their way over the Assam-Burma Road link hacked out of the jungle by U. S. Army Engineers. Annual rainfall of 500 inches will keep the trucks wallowing in mud



off the land. But in Burma, from Lashio northward, the country is almost a trackless jungle to the tops of mountains which average about 13,000 feet, with some peaks running as high as 20,000 feet. These are tough mountains to fly over, but far, far tougher to traverse on foot."

Jungles generally, Colonel Scott was reminded, offer as much or more natural food than do forests back home. He agreed, but added with emphasis, "Not in certain sections of Burma! Such easily gathered foods as breadfruit, durian, pandanus, or palms are too scarce there to do much good." Palms, in particular, with their long, pointed buds in the center of terminal crowns of leaves, seemed to go with the jungles. It is hard to imagine a jungle without them. "Oh, yes," answered the Colonel, "there are some palms, but few of the edible varieties. I've often eaten palm 'cabbages,' both raw and cooked, and they're usually good either way. I've eaten them whenever I could find them, because of their high vitamin content. And in Burma, more than in any other part of the world that I know of, the lack of vitamins—or avitaminosis, as the doctors call it—is serious. I've seen men with holes in their legs large enough to hold a baseball—no, they weren't wounds; it was a kind of tissue deterioration which came from mosquito bites in which a fungus growth had developed. The fungus kept eating the opening larger and larger. But the fundamental cause was the fact that the men thus afflicted were in a run-down condition owing to lack of vitamins. No, in the Burmese jungles you're lucky to find a few berries and ferns to live on."

But how about game? "Very little. Some birds, of course, but often you're wasting ammunition trying to shoot a bird in the jungle. If you can't see where the bird is going to fall, it'll be difficult to find it even if it drops only a few feet away. And a .45 was never designed for shooting either birds or animals. The scarcity of animals in the mountains south of the Chinese border is due, we supposed—at least in part—to the terrific rainfall. There aren't many places in the world where it rains harder than in Burma during the monsoons! As much as 500 inches a year falls in certain parts of the country, and that's a lot of water! You see, the mountain ranges, which are really the foothills of the Himalayas—if you can call mountains from 12,000 feet to 20,000 feet foothills—run generally north and south, all the way from the Salween River to the Naga Hills, which divide India from Burma. Between these ranges run swift rivers, in deep gorges. In the rainy season these rivers often rise as much as 50 feet in a single night! Such streams

limit the movement of wildlife and must wipe out large numbers of animals. So it's not inconceivable that the terrific rains have had much to do with making game so scarce. There probably are other reasons, too, but whatever they are, I know that there is practically no edible game. This is not true of the Naga Hills farther to the north, where there is a good deal of big game.

"In the south, of course, there is ample food. As I said before, Burma was the 'rice bowl of Asia,' but where there's rice there are people—many of them—and most of them hostile, so that you're worse off there than in the barren jungles of the north. On the other hand, if you're forced down in New Guinea or the Solomons, where the natives generally hate the Japs and—thanks to the missionaries—have a high regard for the white man, you will be fed and led to safety. But many of the Burmese will stab you in the back or hand you over to the Japs.

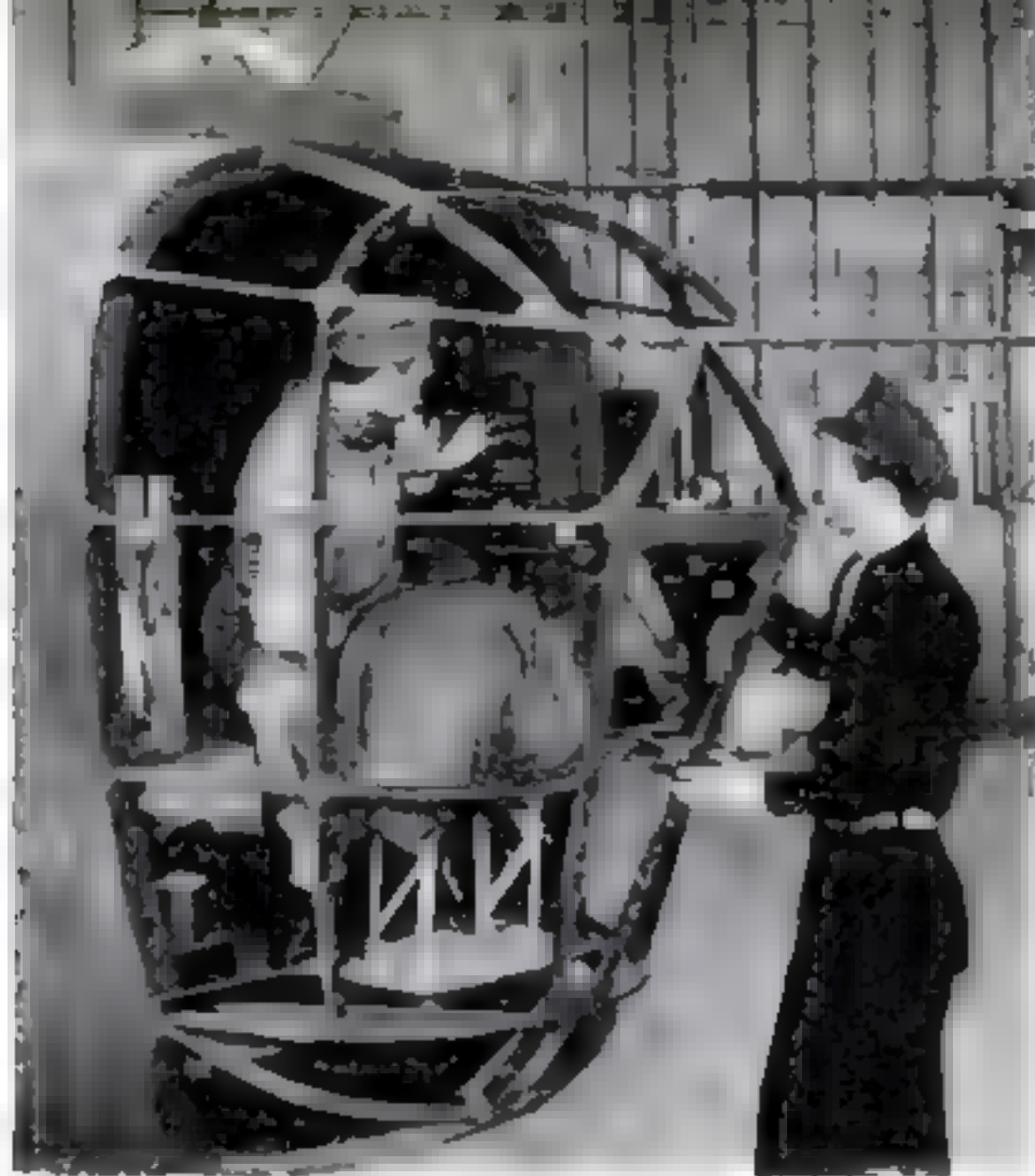
"The greatest enemy, however, is malaria. I've been through villages where 95 percent of the people were sick with that disease. The ordinary malaria that we know about here is bad enough, but the malignant, cerebral variety in Burma is really tough. Often it seems that neither atabrine nor quinine helps very much, but still they're the best drugs known for it.

"Your best bet is to take every precaution to keep from getting malaria. Never go without your shirt, however hot it is, and keep your sleeves rolled down; wear gloves when possible, and tie a piece of string or plant fiber around your sleeves at the wrists. Keep your trousers tucked in your G.I. shoes and never, under any circumstances, be without a mosquito head net. I'd go without food if I had to make a choice between food and mosquito netting when I made up my pack of things to carry into Burma. In fact, I'd take a mosquito net if I had to carry it in my mouth. It's that important.

"Frequently at sundown, standing on some rising ground, I noticed a haze in the valleys which at first I thought was a ground fog. The superstitious Burmese would say, pointing to it, 'Look, the Curse.' And indeed it was, but not as they supposed it. That miasmatic haze consisted of myriads of the Anopheles, or malaria-bearing, mosquitoes, which swarm at sundown and are particularly obnoxious for three or four hours thereafter. Don't say, 'Oh, mosquitoes never bother me.' These mosquitoes are hungry—and aren't particular!"

Capt. George W. Shoenfelt, of the Ferry Command, who had flown with the Colonel over the Orient (*Continued on page 218*)



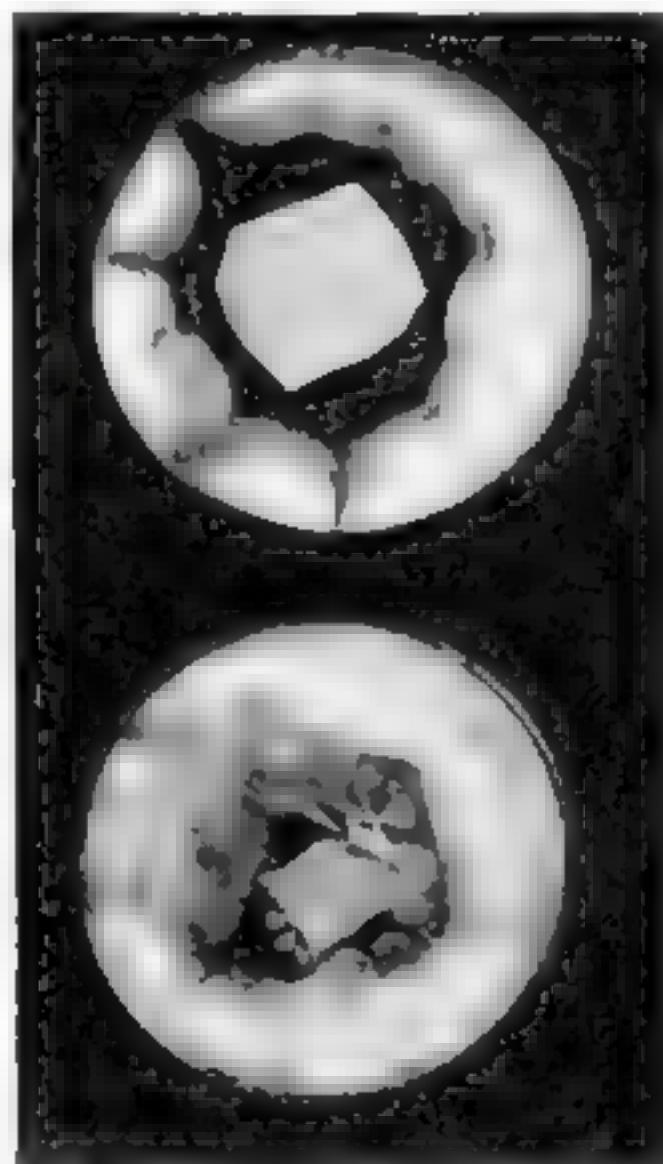


**MOCK-UPS HELP TRAIN FLYERS.** Time, gasoline, and plane wear are saved by the U.S.A.A.F. Training Command through the use of mock-ups to familiarize future air fighters with the conditions under which they will work. Above is a full-scale reproduction of the bombardier's compartment of a B-24 Consolidated Liberator bomber. Built at the Central Bombardier Instructors' School at the Carlisbad, N. M., Army Air Field, it helps returned combat veterans pass on their trade secrets to the men who will train future "egg-layers." Lieut. John Esh, student officer bombardier, is learning the layout of the instruments from Capt. Willard Von Jones, 26-year-old veteran bombardier from the Aleutian combat theater.

**FUSES** for hand grenades are X-rayed for safety by a machine developed by General Electric. Riding a movable belt, the fuses cross the beam from a 100,000-volt X-ray tube, which is focused on a fluorescent screen. Any change in the intensity of the glow of the screen, indicating an improper charge in the fuse, is detected by a photoelectric tube. A bell rings, a red light flashes, the offending fuse is marked with a dab of red paint, and a telltale recording is made on a chart. Four thousand fuses can be checked in an hour.



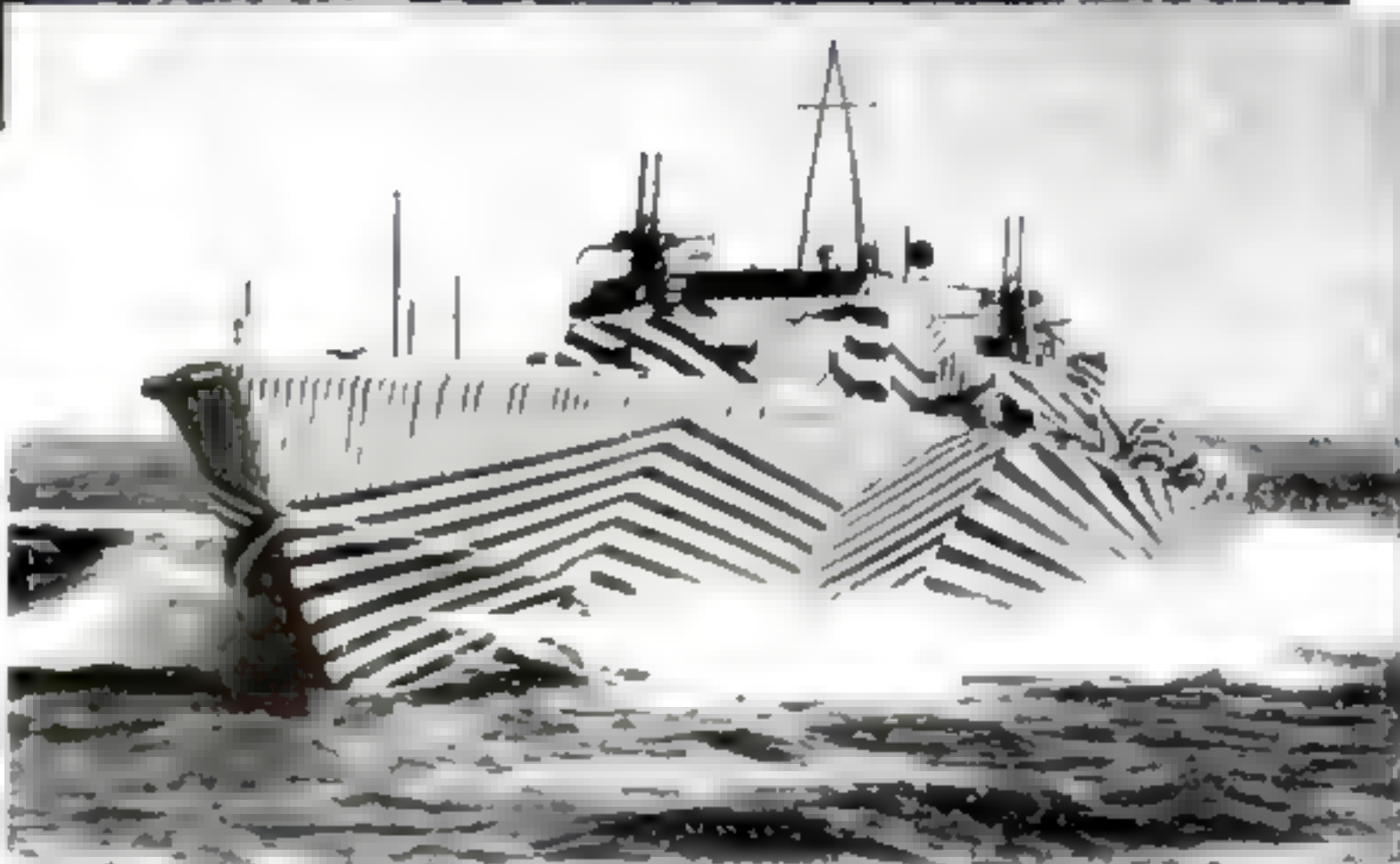
**LASTING PROTECTION** against bacteria and fungi is given fabrics and other materials by the "Puratized process" developed by Dr. Frank J. Sowa, of Gallowhur & Co., New York, N. Y. In the photo below, a treated sample of shoe lining (top) immersed in a culture of athlete's-foot fungus has a large "halo of inhibition," while an untreated piece is covered with fungi.







**BATTLE DRESS** of the Navy's PT boats has several styles, depending on where these hit-and-run craft are active. At the inlet and river-mouth bases of the South Pacific, skillful camouflage blends them with the jungle background, as above. Japanese call these PT boats "Green Dragons." At right, a camouflage of stripes is used to break up the outlines of a boat serving far from shore.



**A WITCH'S BROOM** is tied to the mast of a modern warship on its trial run, just as on early sailing ships. A successful trip, and the broom remains, signifying acceptance and a "clean sweep." Broom-keeper at the Tacoma-Seattle Shipyards, Tacoma, Wash., is Tom Gladding, right.

**CASTAWAYS** using the mirror below signal ships or planes within 10 miles. Sighting through the cross, they tilt the mirror to throw flashes of reflected light. The emergency device is made by General Electric.







## "SUITCASE HOUSES" FOR THE ARMY

A COLLAPSIBLE one-room house that can be taken out of a "suitcase" and set up in three minutes has been developed as a portable unit for use by our armed forces. Erected, the 16 by 15-foot house provides floor space of 250 square feet. Folded (see inset), it fits in a case eight feet wide, 16-foot long, and less than 26 inches thick.

William B. Stout, noted designer, has provided walls that fold open and shut like an accordion. The exterior of the 2,500-pound house, made by the Palace Corp., of Flint, Mich., is H mas te and noncritical lumber. Below, four stages in the erecting of one of these units, which the Army uses as kitchens, shops, offices, and first-aid stations.

### "ACCORDION" WALLS SPEED THE ERECTION PROCESS







# I Fly "Mitchells"

By **ROBERT L. CUNNINGHAM**

*First Lieutenant, U S A A F*

IN 52 blistering raids across North Africa, the Mediterranean, and Rome itself, I helped blast an invasion path that eventually will lead our victorious troops into the heart of Berlin.

We precision-bombed, pattern-bombed, and skip-bombed the Axis troops until their commanders retreated toward fortified Middle Europe.

At first both the Germans and Italians poured flak into our wings like rain on a roof, but we learned to evade this cruel punishment so well that, of seven second lieutenants representing the entire pilot staff of the advance echelon for our bombardment group in Africa, six came through alive.

Only two years ago, I was a senior in liberal arts at the University of Southern California. Nineteen days after Pearl Harbor, I enlisted as an air cadet. Eleven months later, I was

in England, and on November 11, 1942, I landed at Casablanca, after guiding a flight of P-38 Lightnings from Britain. Except for a single sneak flight over the Ruhr in a Flying Fortress, intended to check on my nerve for combat, I had had no taste of war. Now I was due to lash out at Rommel in the desperate drive that pushed him into the sea.

General "Billy" Mitchell would be proud of us were he alive today. Yes, I am a "Mitchell" pilot, and proud of the great plane. Since General Doolittle's Tokyo raid, you may know this medium bomber better as the B-25. These planes are the fastest and most maneuverable mediums ever to take wing. In a heavy bomber, you fly far above the noise of battle, paste your target, and fight your way home. In the mediums, you are part of the battle itself, often roaring in "on the deck," pulling up sharply, and letting go

Drawings by  
**STEWART ROUSE**

**SIDI AHMED MISSION.** An assignment to catch 50 JU-52 transports on a Nazi airfield outside Bizerte was the first big test of the air strategy of the "Gold-Barred Guerrillas." Here is the plan



① CUNNINGHAM'S FLIGHT OF B-25'S SKIMS MEDITERRANEAN SEA SO ENEMY FIGHTERS CAN ATTACK ONLY FROM IN FRONT, AND TO AVOID DETECTION

② ALGERIAN COAST IS CROSSED NEAR BONE, THEN BOMBERS DO CONTOUR FLYING THROUGH THE HILLS UNTIL THEY NEAR BIZERTE, TUNISIA





**GABES MISSION.** Enemy troops concentrated in an orange grove were the target. Fifty Nazi fighters jumped the B-25's. With his top-turret gunner killed and his port engine out, Cunningham crash-landed

with everything you have, within direct range of all antiaircraft weapons on the ground.

The Mitchells haven't missed a show in this war. Designed for pulverizing targets by level bombing, they are standard equipment today in five air forces, including the British, Russian, Dutch East Indies, and Chinese. Built at North American's Cali-

fornia and Kansas plants, these twin-tail, midwing machines carry a crew of five, several .50 caliber machine guns, protective armor, and more than 2,000 pounds of explosives. Their supercharged Wright engines drive full-feathering three-blade props.

Had the Axis threat not been so serious, I would have chuckled over our early tacti-

The problem was to approach the target low enough to escape discovery by ground detection equipment, then bomb from sufficient height to avoid most of the flak and keep clear of the concussion of their own bombs







## A "MUST GET": 1,000,000 GALLONS OF GAS FOR ROMMEL

**1** Searching the strait at 500 feet the three plane element spotted the convoy. While M.I. just tackled the escorting cruiser, Canham and Cunningham broved the flak to take the tanker

**2** Diving to only 10 feet above the water, the two B-25s streaked for the ship dodging and twisting. Close in, they straightened out and at 500 feet turned loose with three 500-pound bombs each

cal plans. We had learned low-bombing tactics at home, sweeping in at roof-top level, dropping delayed-action bombs, and zooming 1,000 feet to escape their searing blasts. I was soon to learn that there's no tougher assignment than low bombing. The enemy gets set in foxholes and pumps a solid curtain of fire straight up as you approach. You must fly through streaming .30 and .50 caliber bullets, explosive 20-mm. and 40-mm. projectiles.

Our first mission carried us over Gabes. We were told that troops had concentrated in an orange grove, so we plastered the area and streaked for Casablanca. My flight over the Ruhr had not prepared me for this one. We saw no enemy on the ground, but out of nowhere 50 Nazi fighters jumped us. On their first pass, they killed my relief top-turret gunner and shot up the left engine. Three ME-109's circled like vultures until our stricken ship crashed, in enemy territory. As we tumbled out and ran for the bush, the Heinies strafed *Miss Mary Jane*—named for my best girl, back in California—until she exploded.

"Friendly" Arabs rescued us. After two of the boys had given them the shirts off their backs for the favor, they turned us over to an Italian patrol. Luckily, the Italian officer missed the .45 I carried in a shoulder holster under my leather jacket. When we were being driven away, I stuck the gun in that officer's face and demanded our side arms. We not only got the guns; the Eyeties started walking. We hid in the hills until one of our patrols came by.

A few days later, we drew our second mission, the airdrome at Sidi Ahmed, in

Bizerte. "Fifty JU-52 transports on the field," Intelligence reported. How should we go in to surprise them before any could be flown away?

We huddled on that one. Joe Helsaback, from Walnut Cove, N. C., had one idea, Frank Gachwandtner, from Fort Atkinson, Wis., another. "It's a cinch," said John Beatty, Kittanning, Pa., "we gotta keep their air power on the ground." Arthur Canham, a San Francisco boy, declared we must hit the deck (contour fly) until the target was approached. I suggested we sweep in from the sea, skimming the waves to protect our top, rear, and bottom. Bill Bishop, New York, agreed with my idea, and Dick Marsh, Philadelphia, sighed for some delayed-action stuff to replace the bombs we were carrying.

Our tactics began to develop on the Sidi Ahmed raid. We dared not go in at 50 feet, for the bombs would explode in our faces. We couldn't sweep in at 8,000, for the Germans would pick us up with detection equipment and bracket us before we hit the target. So we struck out over the Mediterranean, skimming the deck until we were off Bone, where we turned inland, contour-flying over the hills until 10 miles out of Bizerte. Then we started climbing 1,500 feet a minute, holding the air speed at 160. (Ground fire turned loose at Ferryville, 40 miles from the airport.) At 8,000 we leveled off, roaring on through the hell of steel. Poor Bill Bishop went down with a direct hit, the only one of our pilots not to come safely through the campaign.

As soon as flak began to bump us around the sky like kites, we threw the ships into





## SKIP BOMBING KEPT THE AFRIKA KORPS TANKS THIRSTY

**3** One of Cunningham's bombs skipped striking the rear side of the ship and exploding below the water line; another hit the deck, firing the cargo. Canham also scored with a hit on the deck

**4** Four seconds later, when the delayed-action bombs went off, the Mitchells were a quarter of a mile away. Cunningham was in trouble, with his port engine shot out and its prop windmilling

an undulating skidding motion. A little right rudder, slight left rudder, dive slightly, climb a bit. I looked down, saw four lights blink. Seconds later, pebbles cracked against the bottom of the wings. How those missiles were punishing the planes, I learned when we landed. It was a horrible mission tactically, though we plastered the target. For five days we worked on those ships in the blistering desert heat before they were ready for combat once more.

Tough fighter opposition met us every time we went up, for the Germans usually outnumbered us five to one. Though the B-25 can turn inside some fighters, as I have proved many times, there's no point in tempting their guns needlessly. We pilots chinned about tactics every time two or more got together. "Speed of a bomber in combat," we agreed, "is O.K.—but it's maneuverability that will bring us home." A bomber can't run away from a fighter pilot. He can make four passes at you, spitting machine-gun bullets and cannon projectiles, as easily when you're doing 280 miles an hour as when you're crawling at 180. I went up in a Spitfire one day, placing myself in the position of an enemy pilot

to check his reactions to a B-25 squadron. As I noted the turrets swinging rapidly in my direction, keeping me dead in their sights no matter how I rolled and dived, I understood why so many enemy flyers think twice before moving in to attack. I have often seen Nazi fighter pilots dip a wing in our direction two and three times before plunging in toward our formation. They're no fools, those Germans—and certainly they're no supermen, either.

Quickly our board of strategy (we called ourselves the "Gold-Barred Guerrillas") evolved other tactics. We continued going in on the deck. German fighters soon learned not to sneak up from the rear, for the terrific prop wash of the B-25 will dash a small plane into the ground or sea quicker than its pilot can say *über alles*. Nearing the target, we'd stick our noses into a climb, level off at 8,000, climb on to 9,000, dive to 8,000, level off, dump our loads. While approaching the target and fleeing for home, we threw the ships into a sickening combination of skidding and roller-coaster plunges and zooms, varying altitude 1,000 feet at a clip. Again, we would  
(Continued on page 208)



### FACTS ABOUT THE B-25

Wing Span	67 feet 6 inches
Length	54 feet 1 inch
Height	16 feet
Wing Group Area	610 square feet
Weight (approx.)	35,000 pounds



# Shields for Sky Fighters

Layers of glass and plastic, like your car's safety windows, resist shattering by bullets.

Photographs by ROBERT F. SMITH

THINGS were getting hot for the rear gunner of an American medium bomber over Tunisia, one day a few months ago. A Messerschmitt was on his tail, and 20-mm. explosive shells whizzed closer and closer, until one of them smacked right against his window. By all the rules, that should have ended the gunner's career. The fact is that he wasn't even scratched.

Incredible as it seems, a piece of glass saved his life. The window was a typical installation of a modern aviation material for protecting combat flyers, which American factories are now turning out on a mass-production scale. Cautiously, its makers and the armed forces call it "bullet-resistant glass." They emphasize that it was never intended to stand up against explosive shells, though it has done so on occasion. What the manufacturers do say, and rigid Army and Navy specifications demand, is that a block of this glass 5½ inches thick will stop a .50

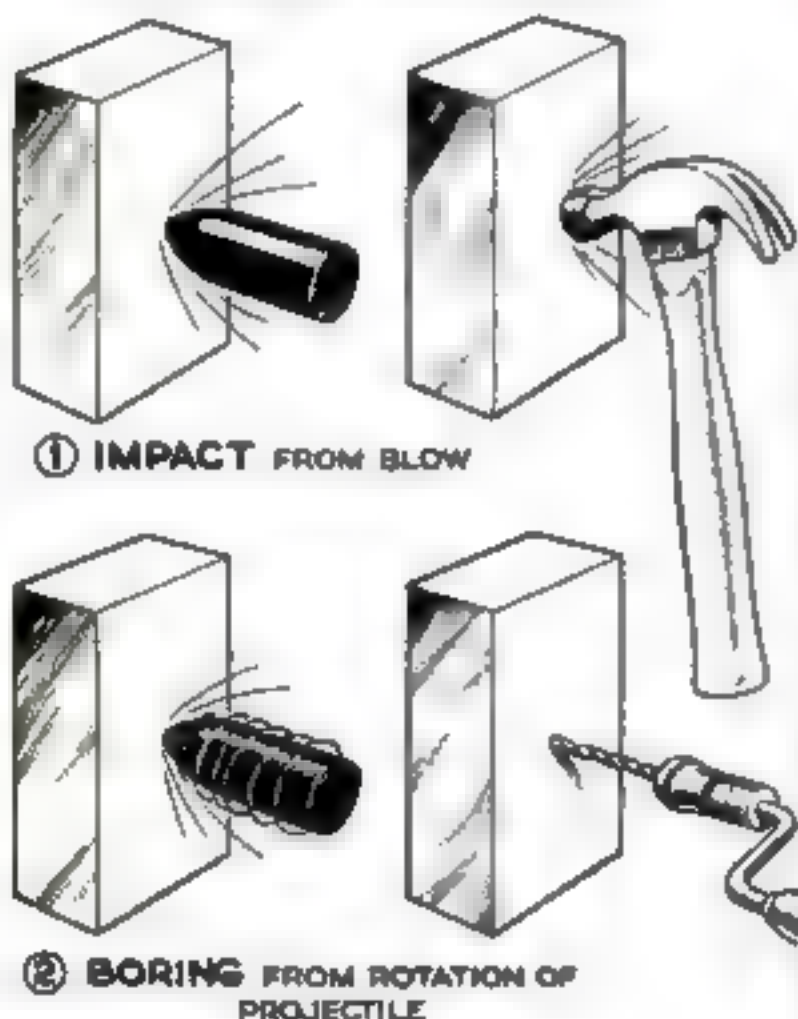
caliber armor-piercing bullet, striking head-on, at a range of only 50 yards. And that thickness may be considerably reduced if only oblique hits, by far the more frequent, are to be guarded against.

In principle, bullet-resistant glass takes after its ancestor, automobile safety glass. Both consist of multiple sheets of polished plate glass, separated by films of transparent plastic. These intervening layers of elastic material are bonded to the glass by heat and pressure. They serve to prevent a crack from spreading through the entire thickness, confining it to a part of the "sandwich." Also, they oppose radial cracking and shattering.

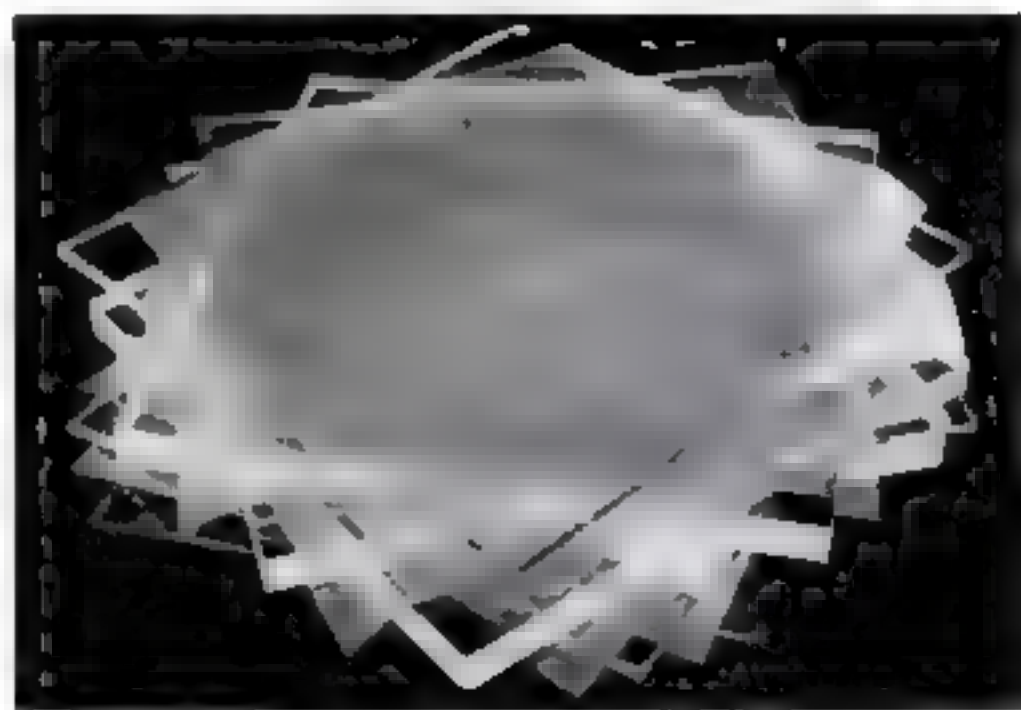
Much depends on the type of plastic used. The kinds first employed for auto safety glass had drawbacks, of minor importance to motorists but serious to airplane crews. For example, long exposure to sunlight tended to discolor the plastic—only slightly in a thin window, but considerably in one of enough layers to resist bullets. Another difficulty was that extreme cold made the plastic brittle, robbing it of resiliency and weakening the bond between layers of glass. Not long before the war, chemists perfected a synthetic plastic, known as plasticized vinyl butyral, which met all objections.

Successfully tried out in automobiles, and then in armored cars used for transporting valuables, bullet-resistant glass was fully developed just in time for war needs, which now consume the entire supply. After hos-

## BULLET-RESISTANT GLASS MUST COMBAT TWO FORCES



## "DEFENSE IN DEPTH"



The glass is actually a "sandwich" composed of layers of polished plate glass and transparent plastic welded together by heat and pressure





A small panel of the new glass—an improvement over the prewar safety glass used in passenger cars and armored trucks—protects the head and shoulders of this P-38 pilot. Because it weighs 13 pounds for every square foot an inch thick, it is employed only in vital areas

ilities end, civilians will enjoy its benefits.

For airplane use, bullet-resistant glass of four or five layers replaces or supplements windows previously made of plastic alone, which had practically no resistance to bullets. Bullet-resistant glass has the added advantage of withstanding scratches, which in time impair visibility through windows of plastic. Like plastic, it can now be formed into many special shapes for airplanes. Cylindrical and conical shapes have been produced.

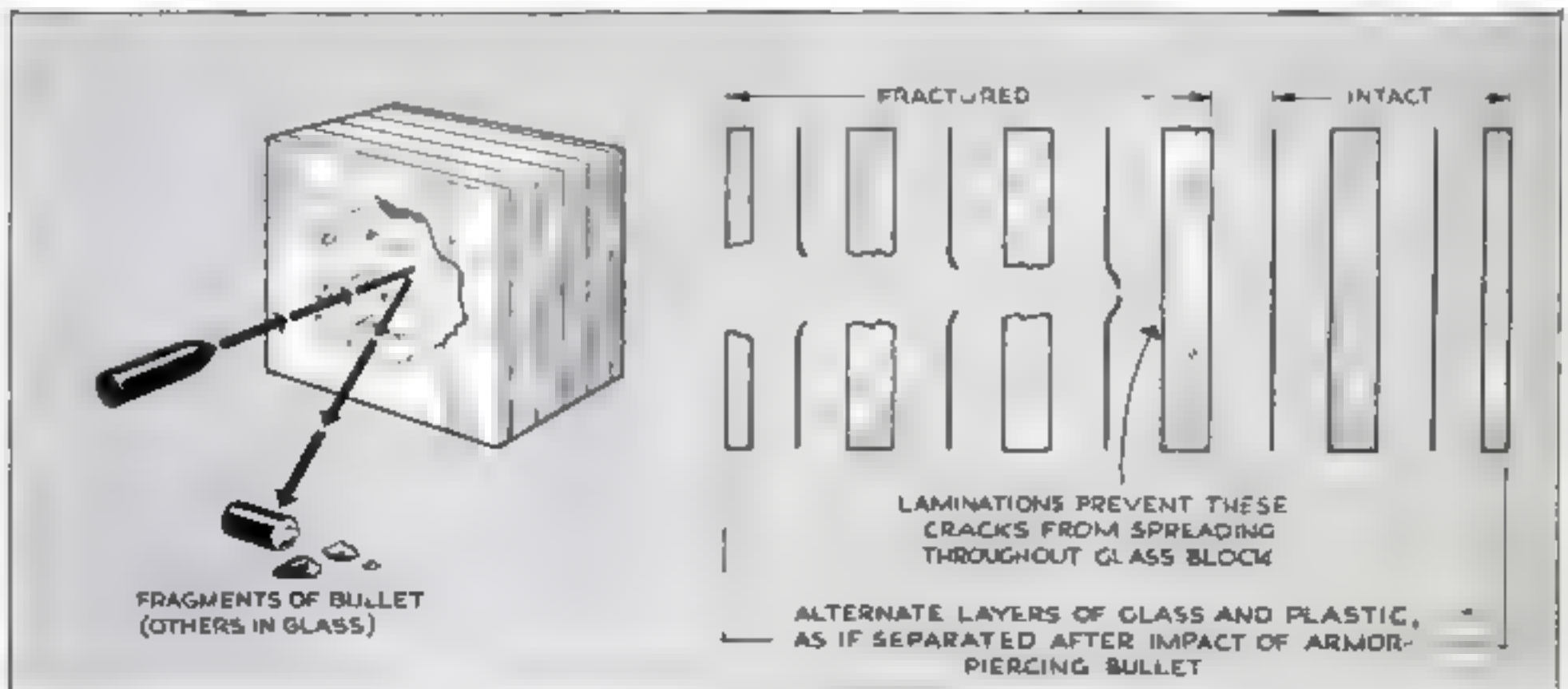
On the other hand, the considerable weight of the new glass has presented a

problem. One square foot of the material, one inch thick, tips the scale at 13 pounds.

How to make windows as light in weight as possible, therefore, is a question that has preoccupied makers and users. One solution has been to keep down their dimensions and mount them close to the eyes of a flyer so as not to restrict his field of vision. A window as small as a foot square gives the tail gunner of a bomber plenty of view to sight his weapon. Likewise, a small block of the glass may be mounted within the cockpit of a fighter, just in front of the pilot's head.

Front-line observers, reporting on the pro-

## IS THE SECRET OF BULLET-RESISTANT GLASS

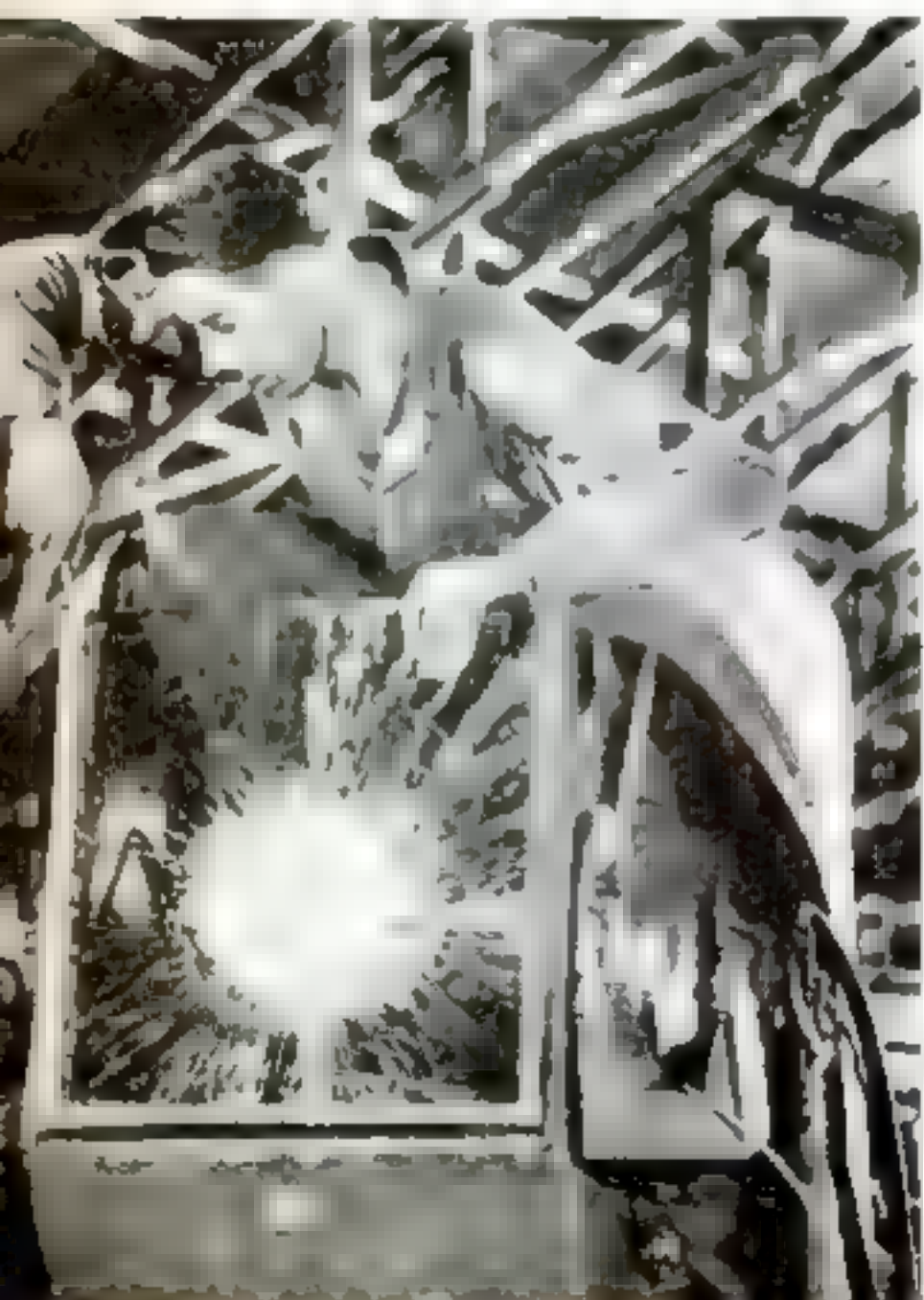




portion of air casualties caused by bullets of various calibers, have helped to show the minimum of glass thickness consistent with safety. In the same way, the angle at which most bullets strike a craft of a given type has come in for study. According to report, the Army wanted to find out the chances of



**GLASS VS. BULLETS.** When a .30 or .50 caliber bullet rips through even a thin piece of the new glass, it is the bullet that shatters, as witnessed by these fragments of bullets fired in the testing range shown on opposite page. Below is an American bomber's "rear window" that did not come off second best. Shown being replaced at an American repair depot in Australia, it stopped a bullet from a Zero before it could bore halfway through



one fighter pilot shooting another while the two planes approached head-on. Two skilled pilots took up planes and tried it, just short of actually shooting. To make sure that their paths would coincide, they came at each other with a straight highway for a guide. With the terrific speed of such planes, both pilots concluded, the fleeting interval between coming into range and swerving to avert a midair collision would have been too short to get in a single machine-gun burst. The importance of this finding may be judged by the fact that if a piece of bullet-resistant glass  $2\frac{1}{2}$  inches thick will stop a bullet heading straight for it, its thickness may be reduced to  $1\frac{1}{2}$  inches to turn away a bullet at 45 degrees, and to  $1\frac{1}{8}$  inches for a hit at an angle of 30 degrees with the glass.

Currently being investigated is the possibility of using two or more blocks of bullet-resistant glass, with the combined thickness of a single layer, but set some distance apart and at an angle to each other. One hoped-for effect would be to tumble the bullet in flight, so that it would tend to sideswipe the second block instead of striking nose first. Even a deviation as small as five degrees reduces the penetrating power of a bullet.

Ultrahigh-speed photographs made in the Creighton, Pa., research laboratories of the Pittsburgh Plate Glass Company—reveal what happens to a bullet after it penetrates relatively thin sheets of the material. Through a cleverly arranged set-up, a single picture tells the whole story.

At one end of a basement test range, the experimenters fire a single round from a standard aircraft machine gun, whose mount is embedded in concrete. The bullet bores through the piece of glass, 50 yards away. An instant later, its picture is taken as it passes a pair of vertical and horizontal sheets of cardboard ruled with two-inch squares. To do this, the camera shutter is left open in the darkened range. A microphone, four feet nearer to the gun than the camera, picks up the sound of the passing bullet. This serves as the trigger to set off an Edgerton-type lamp, which stabs the bullet and marked screens with  $2/1,000,000$  of a second of illumination.

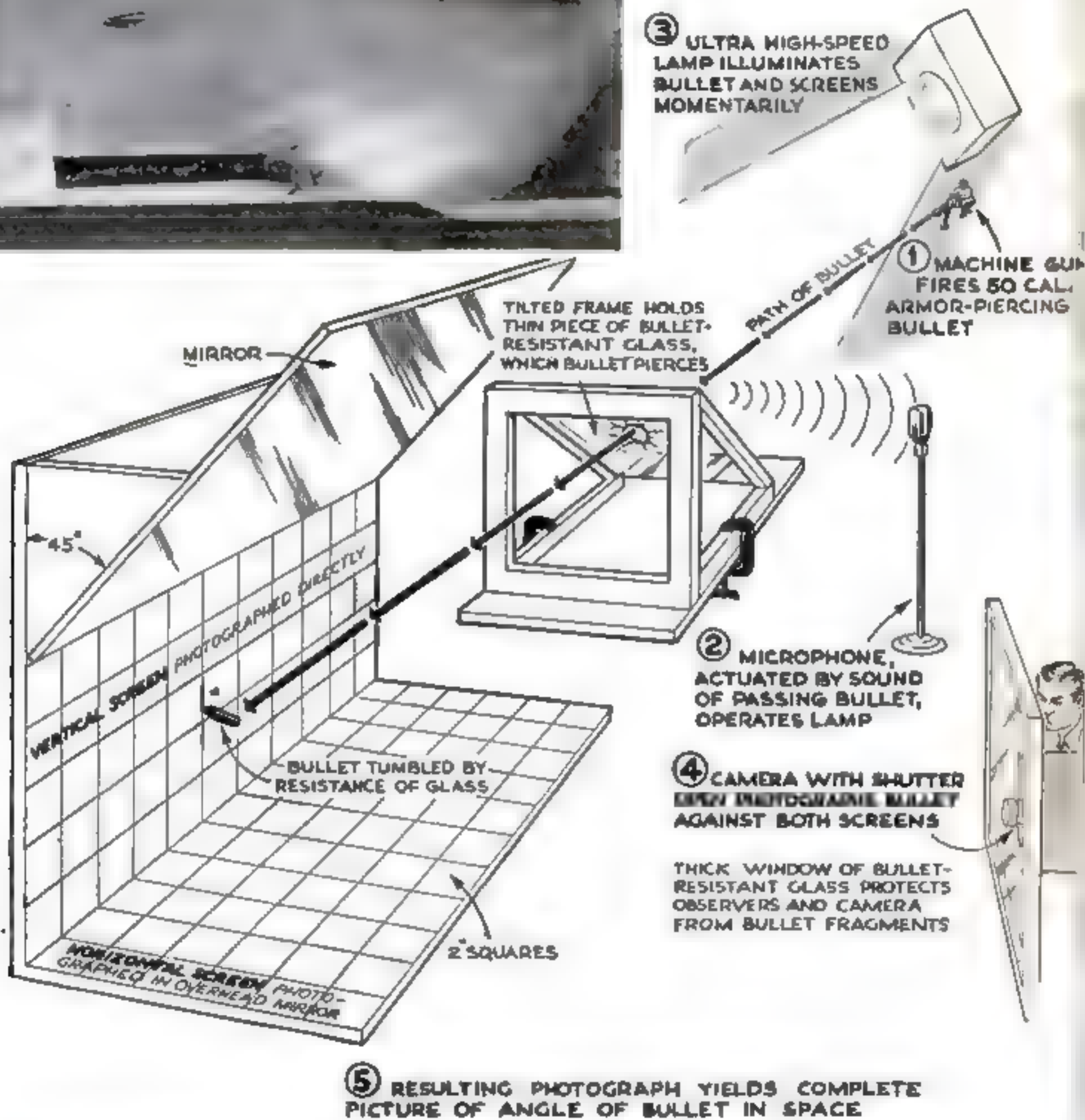
Studies of the pictures show that an inclined plate tumbles a bullet effectively—and that even a thin vertical piece of bullet-resistant glass has some effect. The views also show that laminated sheets as thin as half an inch can rip the copper jacket from a bullet, and even smash the projectile into fragments. From such fundamental research, advanced arrangements of bullet-resistant glass are expected soon to emerge that will save the lives of still more airmen.

—ALDEN P. ARMAGNAC.



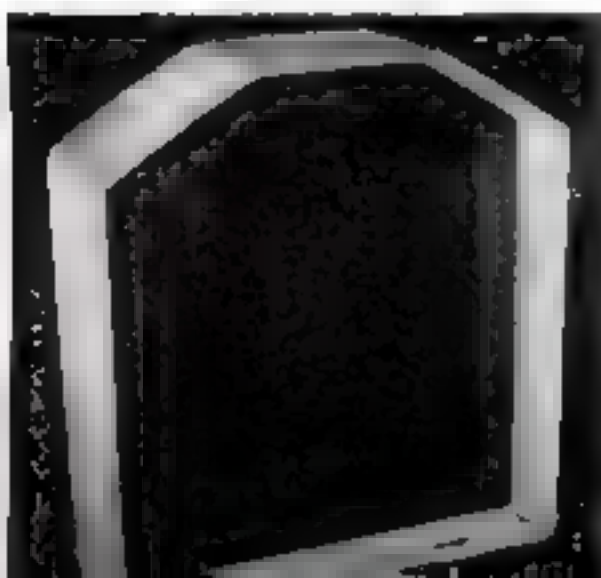


This high-speed shot of a flying bullet was made on the range, diagrammed below, of the Pittsburgh Plate Glass Co., where "bullet-tumbling" effects of various types of glass are tested



**THREE-INCH GLASS,** [shown at left] is used in bombers. Right, the same glass after being hit with a .50 caliber bullet fired from 50 yards at a 60-degree angle. The glass broke—but the bullet didn't get through. A 1½-inch-thick glass

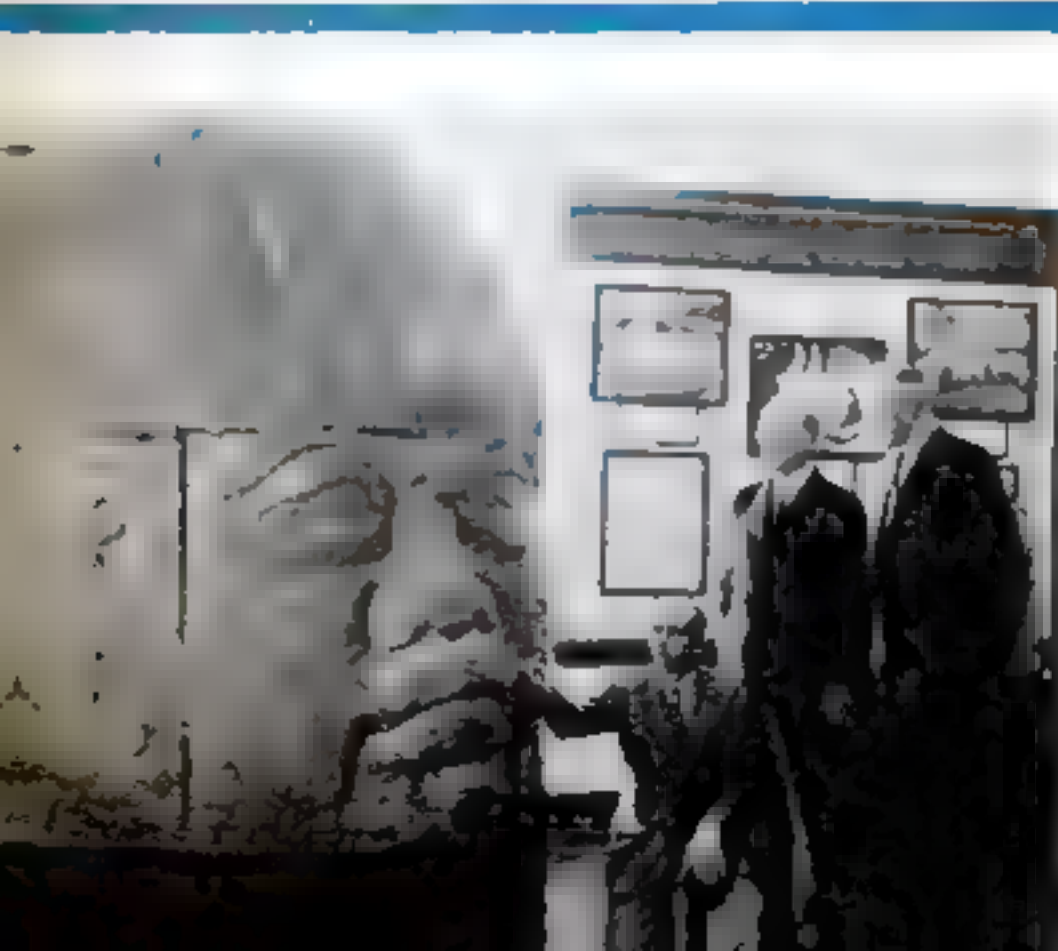
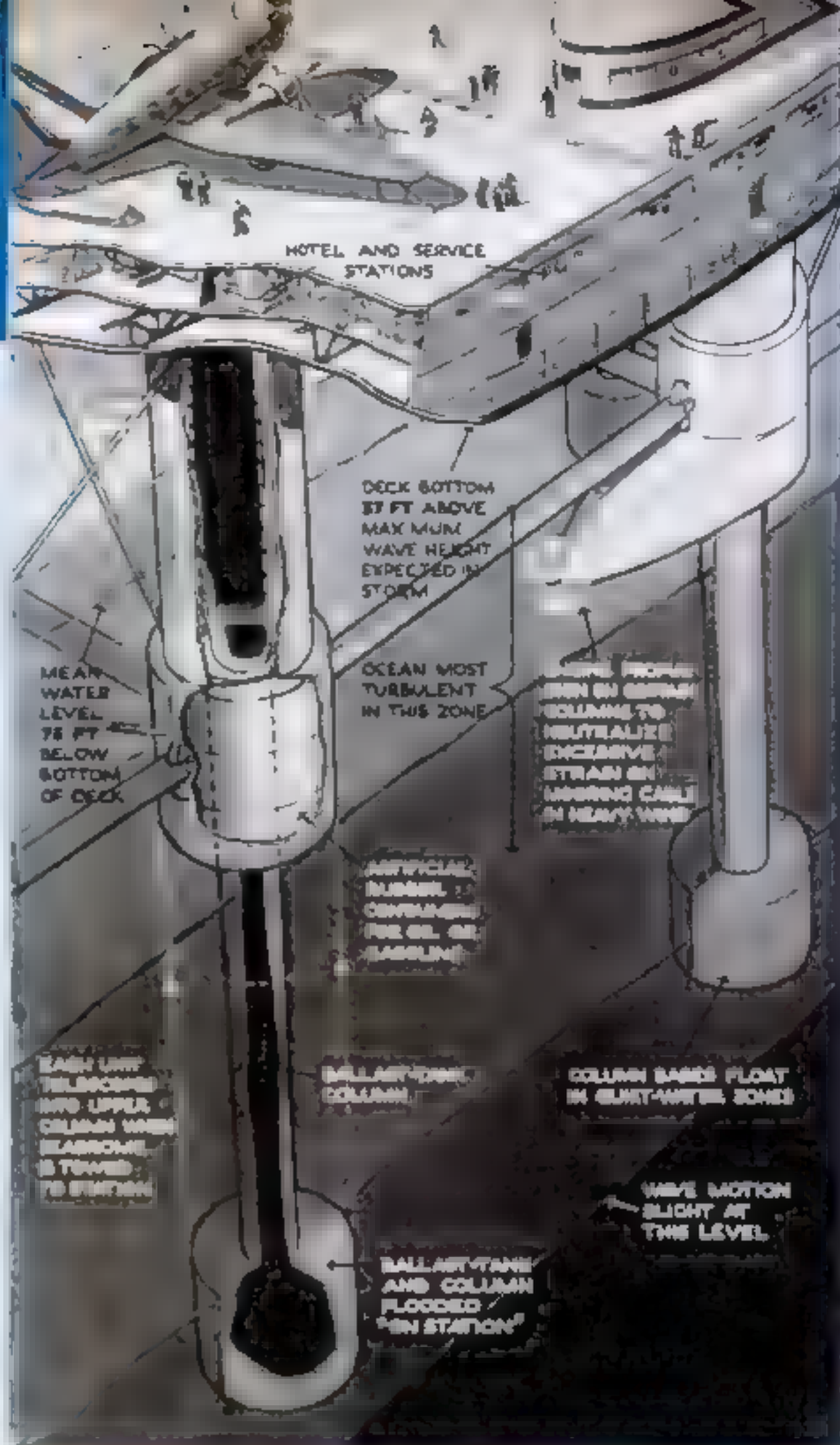
[at left, below] will stop the bullet of the .30 caliber cartridge shown beside it, fired from 50 yards at 45-degree angle. Three-inch glass [right] stops .50 caliber





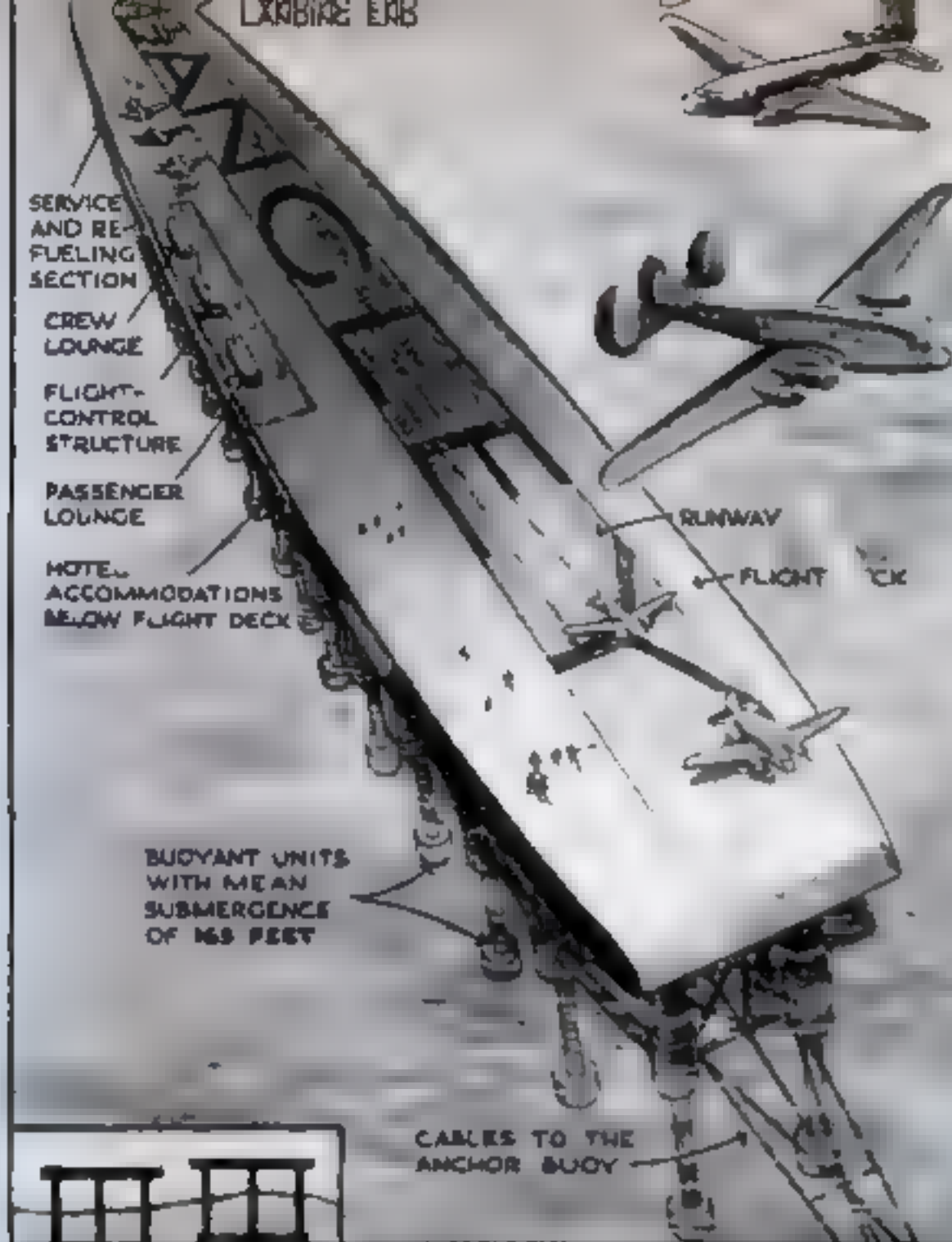
# SEADROME DESIGN IMPROVED

**M**ODIFICATIONS in the design for postwar construction by Pennsylvania-Central Airlines of floating airports (P.S.M., Sept. '43, p. 81), which will dot the Atlantic to facilitate air travel between the east coast of the United States and European and African ports, have been announced by the designer of the seadromes, Edward R. Armstrong, of Philadelphia. Greater streamlining, both above and below the ocean's surface, will reduce air and water resistance and thus relieve tension on the airport's anchor cable. The flight deck will be slightly corrugated for better traction, and will carry counter-sunk lights to guide planes in night landings. There will also be less superstructure than was formerly planned with most of the airport's housing sections placed below the flight deck. Another innovation will be the use of parts of the supports for storing oil, gasoline, and water. The airports will be 3,550 feet long and 400 feet wide, with only 150 feet of the width being used for the runway. Each seadrome will cost \$10,000,000 and will be named after one of the pioneers in the development of aviation.



**EARLY SCULPTURE.** This 20-ton basalt head was unearthed near La Venta, Tabasco, Mexico, by the National Geographic Society—Smithsonian Institution Archeological Expedition. Dr. Matthew W. Stirling (left), leader of the expedition, points out details of the head to Dr. Gilbert Grosvenor, president of the Society (center), and Dr. Alexander Wetmore, assistant secretary of the Smithsonian. The head is believed to have been carved about 1,300 years ago and to have been used in religious rites. It is now on exhibit in Washington, D. C.





How one of the 1,500-ton anchors would appear if it were placed in a city street



Each seadrome will swing from a buoy held by cables to an anchor on the ocean bottom



On short supports airport would rise and fall with waves



Supports that reach to stable-water levels are required to hold airport steady



Airports will be spotted across the Atlantic at intervals of between 575 and 1,200 miles. Being able to refuel at each stop, planes will carry less gas and much greater passenger and freight payloads. Rates for the fastest crossings are expected to be six cents a mile

**A FISH PIPELINE** that sucks up a ton and a quarter of fish per minute from the hold of a boat is being used to bring ashore the catches made by the sardine fleet operating out of Portland, Me. An eight-inch hose takes the fish from the hold, which is flooded with water to prevent damage to the catch. A 12-inch hose then carries the sardines into the cannery, a screen separating water and fish just before they reach the bins. This new method, invented by John D. Toft, is said to have speeded up the unloading of the boats by 600 percent.

FEBRUARY, 1944





# Popular Science Contest Uncovers

## 1001

# Postwar Jobs for the Jeep

More than a third of entrants favor keeping 'em down on the farm . . . Other suggestions range from forest-fire fighting to conversion as a snappy sports car . . . Most soldiers are opposed to "prettying them up."

### FIRST PRIZE, \$100

R. W. Radelet, Vancouver, B. C., Canada

### SECOND PRIZE, \$50

Pvt. Ronald E. Dean, Camp Sibert, Ala.

### THIRD PRIZE, \$25

S. M. Farmer, Chestertown, N. Y.

### EIGHT PRIZES OF \$5

Tommy Bransford, Lonoke, Ark.; Lt. W. L. Hoffman, Camp Forrest, Tenn.; Miles E. Hoisington, Detroit, Mich.; Pfc. Robert W. Huzzard, Wright Field, Dayton, Ohio; Joseph Krucher, New York, N. Y.; Ernest Prete, Staten Island, N. Y.; Ray Ring, Framingham, Mass.; N. Spector, Waco, Tex.

### HONORABLE MENTION

Mrs. Erol W. Bowie, Northampton, Mass.; Nathan Bridwell, Midland, Ind.; Lt. David F. Brinegar, Camp Tyson, Tenn.; Miss Carolyn Crawford, Dallas, Tex.; Pvt. Stanley Hayman, Bolling Field, Washington, D. C.; Thomas K. Hendryx, Pittsburgh, Pa.; Hugh G. Jennings, St. Louis, Mo.; J. T. Lancaster, Hamilton, Ont., Canada; Joseph A. Reif, Philadelphia, Pa.; Pfc. A. W. Swahlen, Atlanta, Ga.; C. J. Williams, Harrison, Tenn.

OUR little wonder warrior, the American jeep, which has won unbounded admiration by its performance on fighting fronts and behind them in every quarter of the globe, is not going to have any difficulty in finding employment after the war.

This was made clear by the flood of ideas submitted in our contest (announced P.S.M., Aug. '43, p. 101), for the best suggestions on peacetime jobs for the sturdy, overpowered little machine. And, judging from the letters submitted by contestants, the jeep's reward for its part in winning the war is likely to be, for the most part, a lifetime of hard work down on the farm.

Out of almost 1,200 persons who entered the contest, more than 400, including the winner of the first prize, thought the proper postwar place for the jeep was the farm, where its chores would take in about everything now performed by man, beast, and machine, from plowing to harvesting—and then on to marketing.

Letters came from every section of this country, as well as from Alaska, Canada, Cuba, and South America. Many came from men in the armed services, who spoke of the jeep not only with pride but with affection. Scores of contestants cleverly illustrated their suggestions. A few turned to verse to express their ideas, and one ingenious entrant even worked out an acrostic to boost the jeep's potentialities. So numerous and so meritorious were the ideas submitted that POPULAR SCIENCE increased the number of prizes from eight to 11 and included 11 honorable mentions.

Jobs were found for the jeep not only in the fields but in the forest and the factory, on city streets and on the cattle range, in railroad and highway construction camps, at airports, on golf courses and race tracks, on college campuses, and on backwoods roads leading to favorite fishing waters.

It was assigned to postmen and doctors in rural districts, to road surveyors and inspectors, to electric-power workers, to telephone and telegraph wire stringers, and to a wide variety of construction, maintenance, and repair jobs. Some suggested it be turned into an ambulance, for service not only in poorly developed sections of this country, but also in China, India, and Africa, where it would help to carry on the work of American humanitarianism.

Many saw the peacetime jeep as an aid in the protection of life and property. These assigned it to police duty—local, state, and F.B.I.—and fire fighting, particularly in the forests. More

First prize winner R. W. Radelet foresees a busy career for the jeep as a machine-of-all-work for the small farmer who cannot afford to own a large number of powered implements. He would have the vehicles sold through mail-order houses, which would also offer a complete range of attachments for farm work.





BLOWING

WEEK HARBORING

ING HAY



MOWING MACHINE



CONVERTING PULLEY POWER



EXTENSION PLATFORM FOR  
FRUIT SPRAYING & PICKING

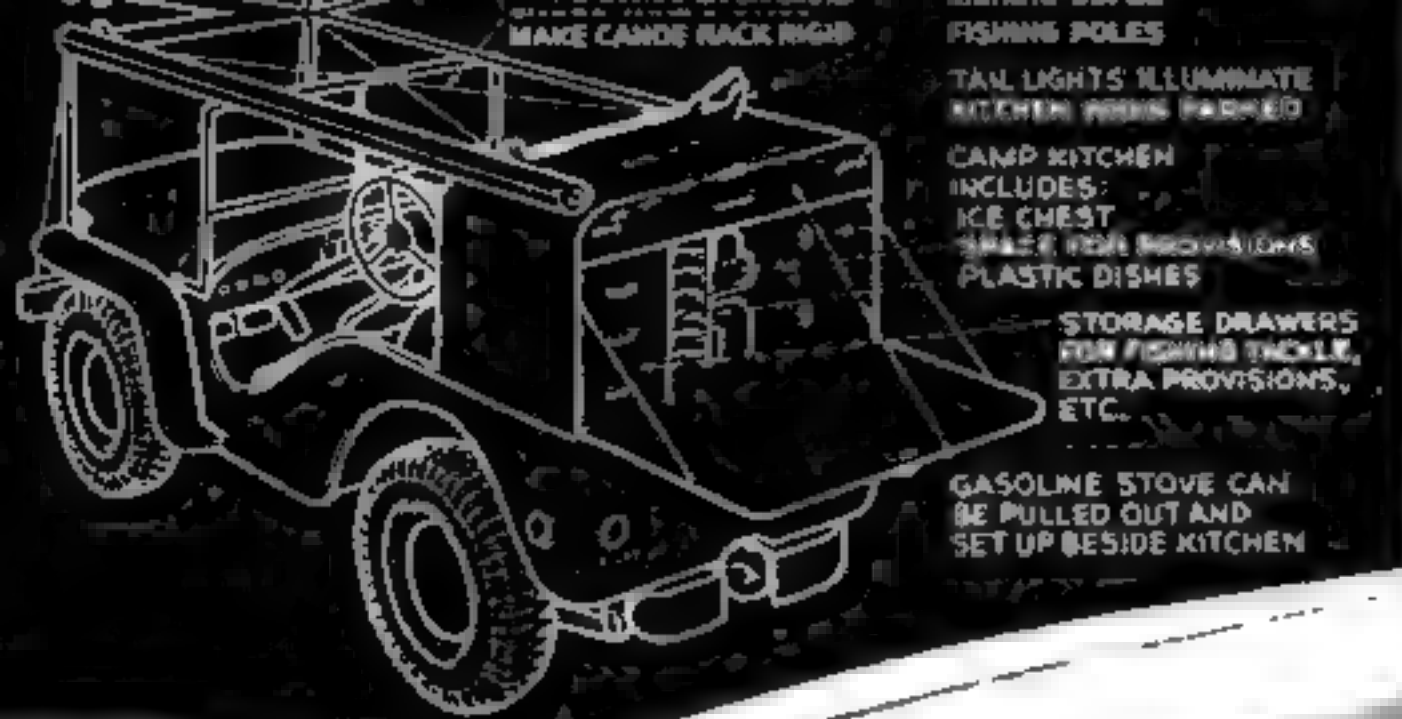


LIGHT DELIVERY TRUCK

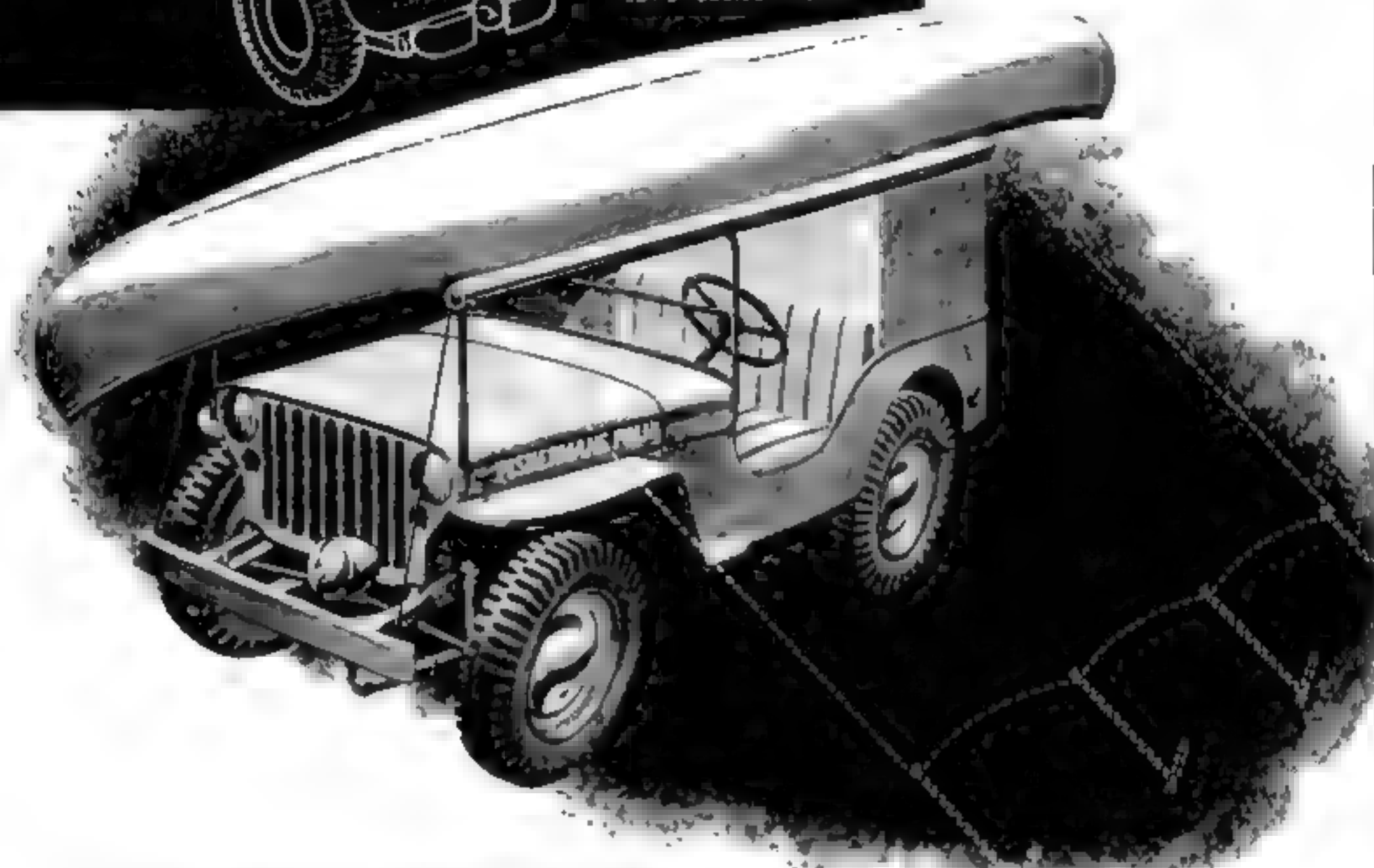


PERSONAL TRANSPORT





Visions of peacetime fishing trips inspired Private Don's prize-winning idea. The "folly," he says, would carry anglers to unfished backwoods streams—with a canoe, built-in camp kitchen, and handy roller tent



than 200 suggested converting the machine to commercial uses, mostly as a light delivery truck, and into a pleasure car.

Some of the conversion ideas called for considerable alterations. An example of the imagination used in transforming a jeep into a sports car, disguised by streamlining and radiant in paint and plastics, is shown in an airbrush painting in full color submitted by Ray Ring, of Framingham, Mass., and reproduced on page 85.

Incidentally, the idea of prettying up the jeep to serve as a pleasure car drew cries of pain from servicemen. While most of them expressed hopes of owning a jeep after the war, many of them simply for the pleasure of driving it around, the servicemen wanted it to retain its present rugged homeliness. Lt. W. L. Hoffman, of Camp Forrest, Tenn., who was awarded a prize, voiced this opinion:

"In the service we all know and love the jeep (the one-quarter-ton truck to us). We've driven it and nursed it, cussed it and

blessed it. We know that it's the best car in the world—for the job it was meant to do; but to make a pleasure car out of it—never! That would be like dressing one of our tough old 'top-kicks' in diapers. The jeep was meant to do a man's job in rough country—not to take 'old women' to tea parties."

"But," he continued, "there are many jobs for jeeps in peacetime—jobs that are commensurate with its abilities. On the farm, for instance, they'll do anything a horse will do, except whinny—and you don't have to feed them when they're not working."

Lieutenant Hoffman's omnibus reference to the jeep's farm-work potentialities was amplified by the first-prize winner, R. W. Radelet, of Vancouver, B. C., who emphasized the value of the jeep to the small farm operator who can afford only a single machine. In such hands, he said, the jeep could be used in the orchard for spraying and picking. In the fields it could be used as a tractor with a gang plow, a mower,



and a rake. It could also be used as a truck and a trailer car to haul produce and stock. It could be employed as a stationary power plant, and it could carry workers to and from the farm.

A soldier with his mind on the pleasures of peace won second prize with an idea to adapt the jeep to a "fisherman's folly." A rack on top could carry a canoe, and the back seat could be converted into a camp kitchen, with ice chest, plastic dishes, storage drawers for fishing tackle and provisions, and a gasoline stove. Rollers at the sides would enable the lowering of canvas to make the jeep a shelter. The soldier, Pvt. Ronald E. Doan, of Camp Sibert, Ala., suggested that all the attachments could be sold as a unit, to be installed by a local mechanic.

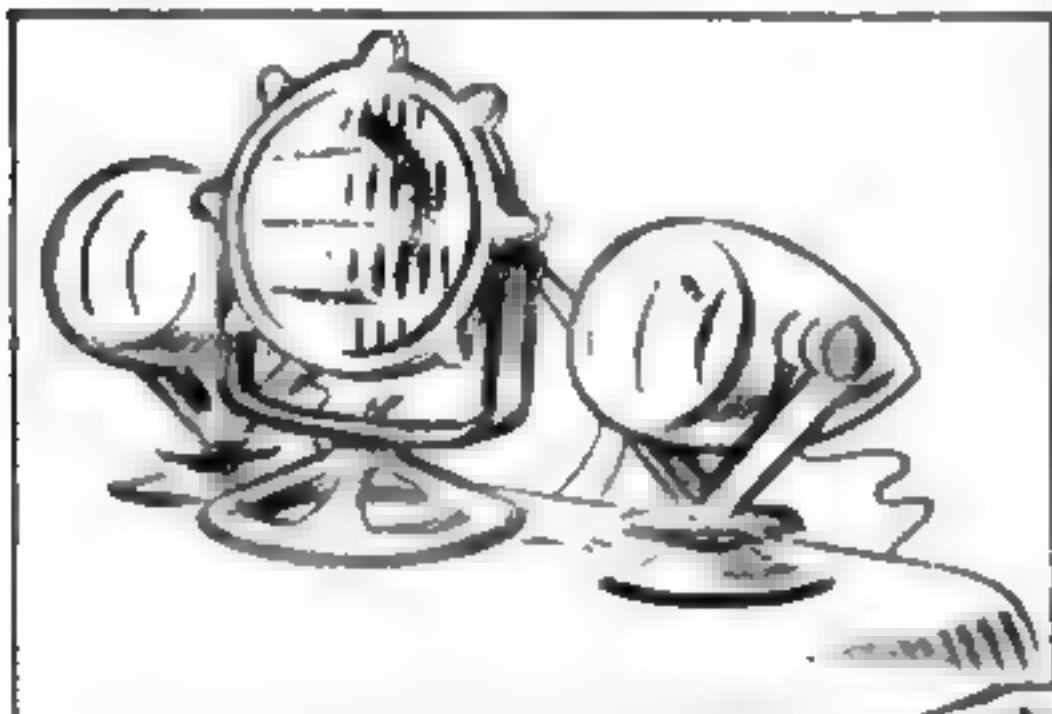
"The 'folly's' four-wheel drive," he wrote, "would pull it farther into the backwoods and nearer to unfished streams than any pleasure car would dare to venture. Upon arriving at your selected spot, pull down the roller tent, open up the kitchen, and there's



Mc. H. E. Draft and his buddies at Fort George Wright, Wash., made a convertible coupe of their air-conditioned jeep, by the addition of a removable plywood cab. Accessories include radio and ash trays

your camp—deluxe and Dad's delight."

The winner of the third prize, B. M. Farmer, of Chestertown, N. Y., envisioned a dozen uses for the peacetime jeep, the first of which was to transport men and equipment to forest fires in remote areas, where its ability to travel over logging and tote roads gives it a big edge over regular cars and trucks. This same ability, he said, would make the jeep useful to logging companies, in hauling supplies by trailer. He also suggested that the jeep be used to carry doctors, police, and border patrols



This drawing, submitted by Joseph Krucher, of New York, N. Y., illustrates his idea of the jeep as a speedy, maneuverable hose cart that could dash to the scene of a fire and have hose lines laid and attached to hydrants before the heavy pumps arrived





over roads choked with snow or mud, that it be used on farms as a tractor and a pick-up, and that it supplement riding horses at summer hotels, which could rent jeeps to guests to tour the surrounding country.

Among ideas for converting the jeep into a forest-fire truck was the prize-winning entry of Ernest Preto, of Staten Island, N. Y. He proposed that the jeeps be covered with a thick asbestos shell and equipped with a revolving turret with two nozzles, "which would shoot water the same as the turret guns on an airplane shoot bullets." A sprinkling device attached below the front of the radiator would spray ground fire. Water for the apparatus, when not available from streams or lakes, would be drawn from a tank car towed by the transformed jeep.

Joseph Krucher, of New York City, also won a prize for his suggestion that the jeep be turned into a hose cart for city and rural fire departments. With its speed and maneuverability, it could race through traffic and have the lines attached to hydrants and ready for action by the time the heavy pumpers arrive. He also suggested that fire departments use the machine as a searchlight unit.

One of the most interesting letters was submitted by Tommy Bransford, 16 years old, of Lonoke, Ark. His letter, which contained an even dozen ideas, was awarded a prize. Farmers, rural doctors, mailmen, forest rangers, sportsmen, service-station operators, and cowboys "riding the fence"—to inspect it for breaks—were among his potential users of the peacetime jeep.

In his suggestion that the jeep would

be ideal for hunting and fishing trips, Tommy considerably thought of the women folks. With a converted jeep, he explained, a man "could go without worrying about taking the 'good' car away from his wife, who hates to have old fishing smells in it for months after one of his trips."

A considerable number of contestants brought up the point of how the Government would dispose of the jeeps. Some took it for granted that they would be sold in huge lots to manufacturers and dealers. But this disposal method was vigorously opposed by others, who saw in it a threat to the new-car market after the war. One of these, Pfc. Robert W. Huzzard, Army Air Forces, Wright Field, Dayton, Ohio, won a prize by suggesting that the jeeps be converted into ambulances and given to the American Red Cross for work in the Orient and Africa. The drawing which accompanied his entry is reproduced below.

Another opponent of putting jeeps on the open market was Edwin T. Brown, of Wilkensburg, Pa., who urged that we give the jeeps to our Allies or "bury them where they are" when peace is attained. He advised manufacturers to scrap their dies after the war and go on with the building of the automobiles of the future. Consigning peacetime jeeps to the category of toys, he declared: "We have to get on with the building of helicopters."

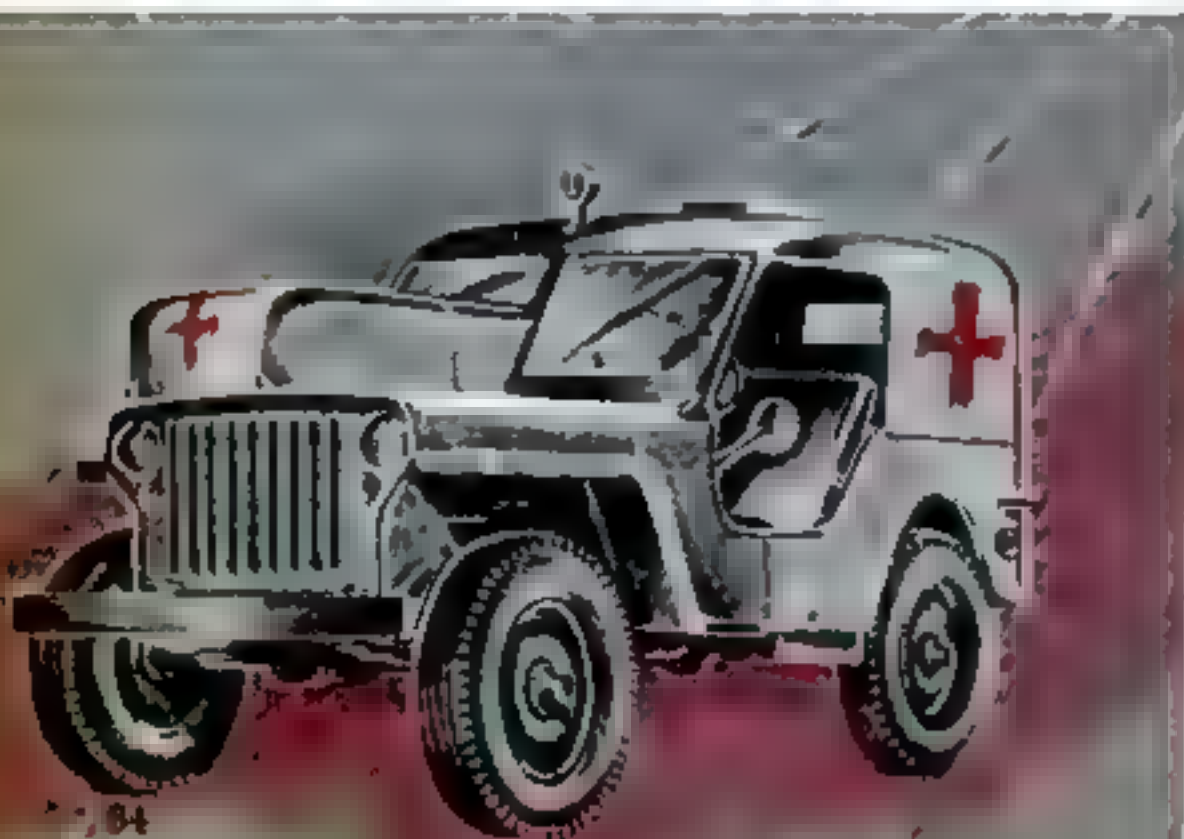
Perhaps a partial answer to this argument was contained in the suggestions that peacetime jeeps be used to haul the great planes of the future onto and off the landing fields, and to shuttle material and men around aircraft and automobile factories.

Other contestants believe the jeeps should be sold or rented by the Government directly to the persons who would use them. Pfc. Ralph R. Brown, in a V-mail from overseas, suggested that the Government establish depots at discharge points and sell or auction the jeeps to men leaving the service. Another serviceman proposed that a soldier be given his choice between a jeep and a bonus.

In a letter from Treasure Island, Calif., a U. S. Marine stated his wish simply:

"Like many another serviceman, I'd like to own one after the war—but no fancy paint, bright aluminum, white side walls, or brassy horn for me. You can put me in an order for one just as it is."

Pfc. Robert W. Huzzard, of the U. S. Army Air Forces, Wright Field, Dayton, Ohio, won a prize by suggesting that the quarters be converted into ambulances and given to the American Red Cross for use in postwar relief work in Africa and the Orient. His letter was accompanied by the drawing reproduced below







## As a Sports Car

Contestant Ray Ring, who made this painting of a sports jeep, wants accessories manufacturers to sell racy-looking fenders; a convertible top with roof panel that folds forward with the windshield (1); a grille with removable plates to streamline headlights (2); combination stop light and strap buckle (3) to hold down folded top (4); and supplementary arched bumpers





**GRADUATION** exercises in the rope-rigging course at Fort Belvoir, Va., are vigorous, with trainees coasting down "the high line" in slings they have tied themselves. Slings are made of a bowline on a bight

# Knot-Tying Obstacle Race

**ENGINEER SOLDIERS LEARN THE ROPES AT FORT BELVOIR  
—AND RISK THEIR NECKS TO PROVE THEIR HANDIWORK**

**K**NOTS are as important to engineer soldiers as to sailors. Other soldiers' lives often depend on the engineers' ability to tie knots which will stay tied. At the Engineer Replacement Training Center, Fort Belvoir, Va., trainees are given 17 scheduled hours of instruction in knot-tying. If old-fashioned Army teaching methods were used, the subject would be boring, but Major I. J. Dalton, of the Pioneer Section, and Captain C. W. Kull, of the Rigging Subsection, have made it so interesting that the trainees devote much of their scanty spare time to study of the knot-tying art. High spot of the instruction is the trip that each trainee must take over the "knot obstacle course." This proficiency test is spiced with the elements of competition and physical hazard. "One bad knot," the boys say, "and you go down like hell!" The obstacle course consists of three 20-foot-high timber towers, which the trainees ascend and descend by means of rope ladders, slings, and other rigging devices made secure by knots which they tie themselves. Grand finale is a triumphant coast from the last tower to the ground in a bowline on a bight.

The clove hitch secures the rungs of a ladder as a trainee works his way up onto a tower. This knot tightens under strain, but can be easily cast off

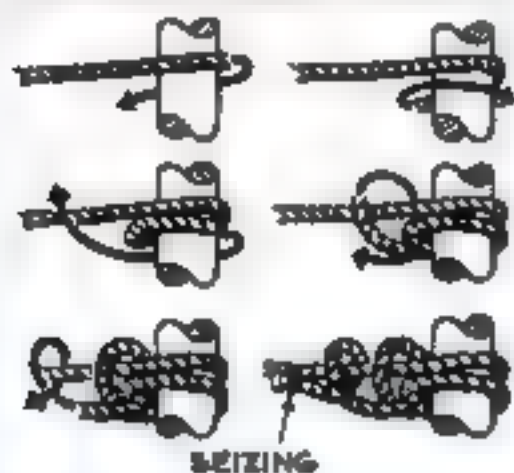




# THE ARMY'S 10 KNOTS ... AND HOW TO TIE THEM

## ANCHOR KNOT-

USED TO FASTEN A CABLE OR ROPE TO AN ANCHOR, OR FOR USE WHEN THERE WILL BE A SLACKING AND TIGHTENING MOTION ON THE ROPE



## MOORING KNOT-

USED TO MAKE FAST A ROPE TO MOORING POST OR SHUDDING POST. PERMITS A LOAD TO BE EASED OFF WITHOUT LOSING CONTROL OF ROPE



## BOWLINE ON A BIGHT-

USED WHEN A DOUBLE LOOP OR SLING IS REQUIRED, AS IN A BOATSWAIN'S CHAIR. ALSO TO FORM A LOOP IN A ROPE WHEN ENDS ARE NOT AVAILABLE



## THE BOWLINE-

USED TO FORM A LOOP OF ANY DESIRED SIZE, THAT WILL NOT SLIP EASY TO TIE AND UNTIE. WILL NOT JAM



## SQUARE KNOT-

USED TO JOIN TWO ROPES OF EQUAL SIZES



## SINGLE SHEET BEND-

USED TO JOIN TWO ROPES OF DIFFERENT SIZES



NOTE-WHEN MAKING A SINGLE SHEET BEND, THE FIRST BIGHT SHOULD BE MADE WITH THE HEAVIER ROPE

## TIMBER HITCH-

USED TO HAUL LOGS, SPARS, OR ANY LONG, ROUND OBJECT WITH PULL PARALLEL TO OBJECT TENSION SHOULD BE MAINTAINED AT ALL TIMES. EASY TO TIE AND UNTIE AND WILL NOT JAM



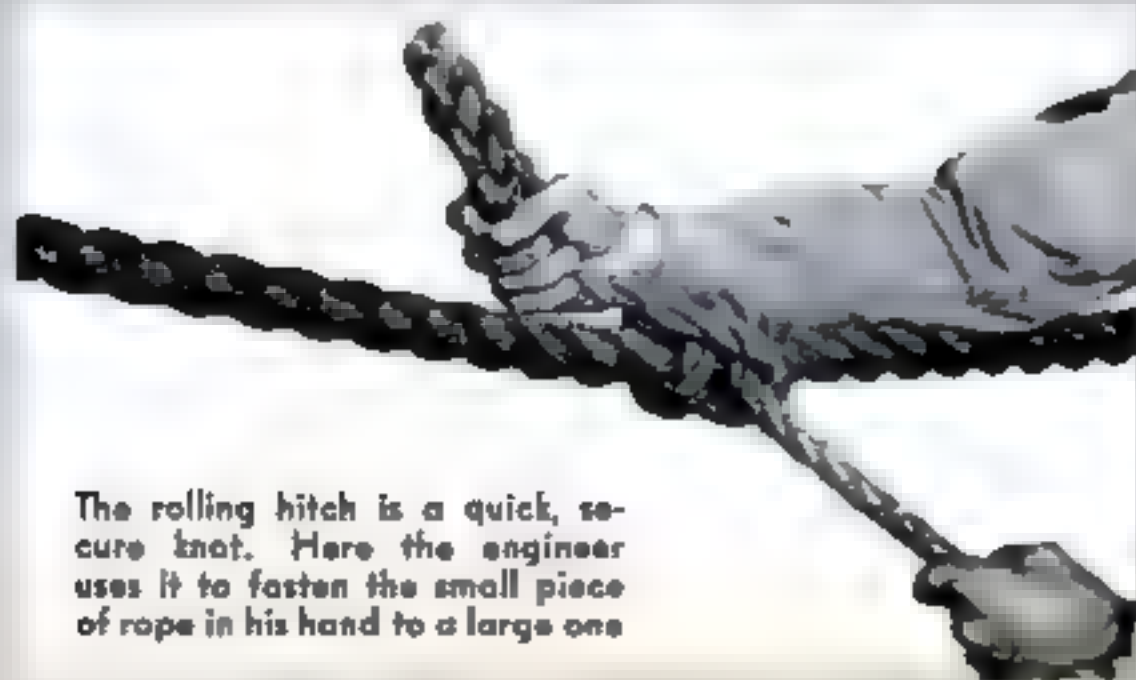
## ROUND TURN AND TWO HALF HITCHES-

USED TO FASTEN A ROPE TO A SPAR OR OTHER OBJECT (FOR PERMANENCY, RUNNING END SHOULD BE SEIZED TO STANDING PART)



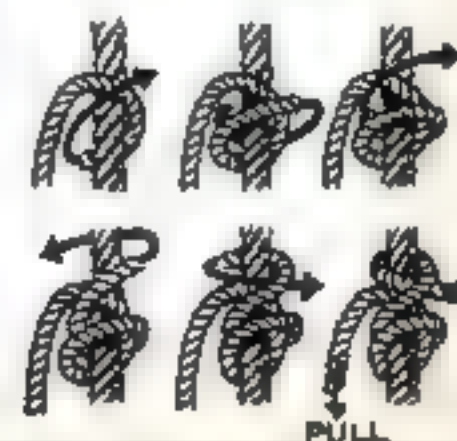
## CLOVE HITCH-

MOST WIDELY USED HITCH IN FIELD RIGGING. WILL TIGHTEN AS TENSION IS APPLIED, NO MATTER WHICH END OF HITCH IS PULLED ON. USED TO FASTEN GUY LINES TO ANCHORAGES AND SPARS



The rolling hitch is a quick, secure knot. Here the engineer uses it to fasten the small piece of rope in his hand to a large one

THE ROLLING HITCH-  
USED WHEN FASTENING ONE ROPE TO ANOTHER, ESPECIALLY A SMALL ROPE TO A LARGER ONE



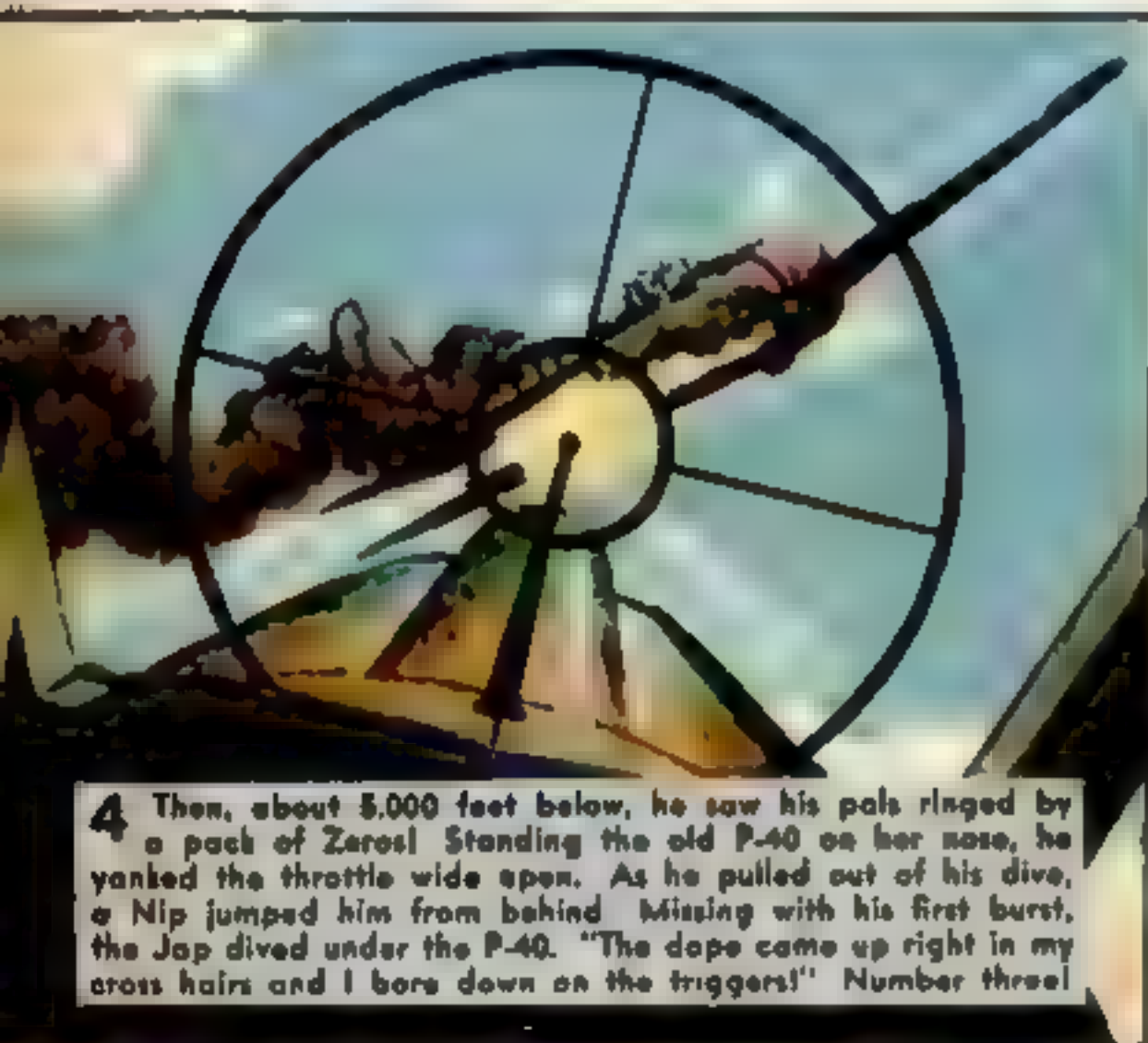


# He Got Action!

By FRANK TINSLEY

The adventures of a lifetime were crowded into four thrill-packed hours in this saga of American courage in the flaming skies of the South Pacific.

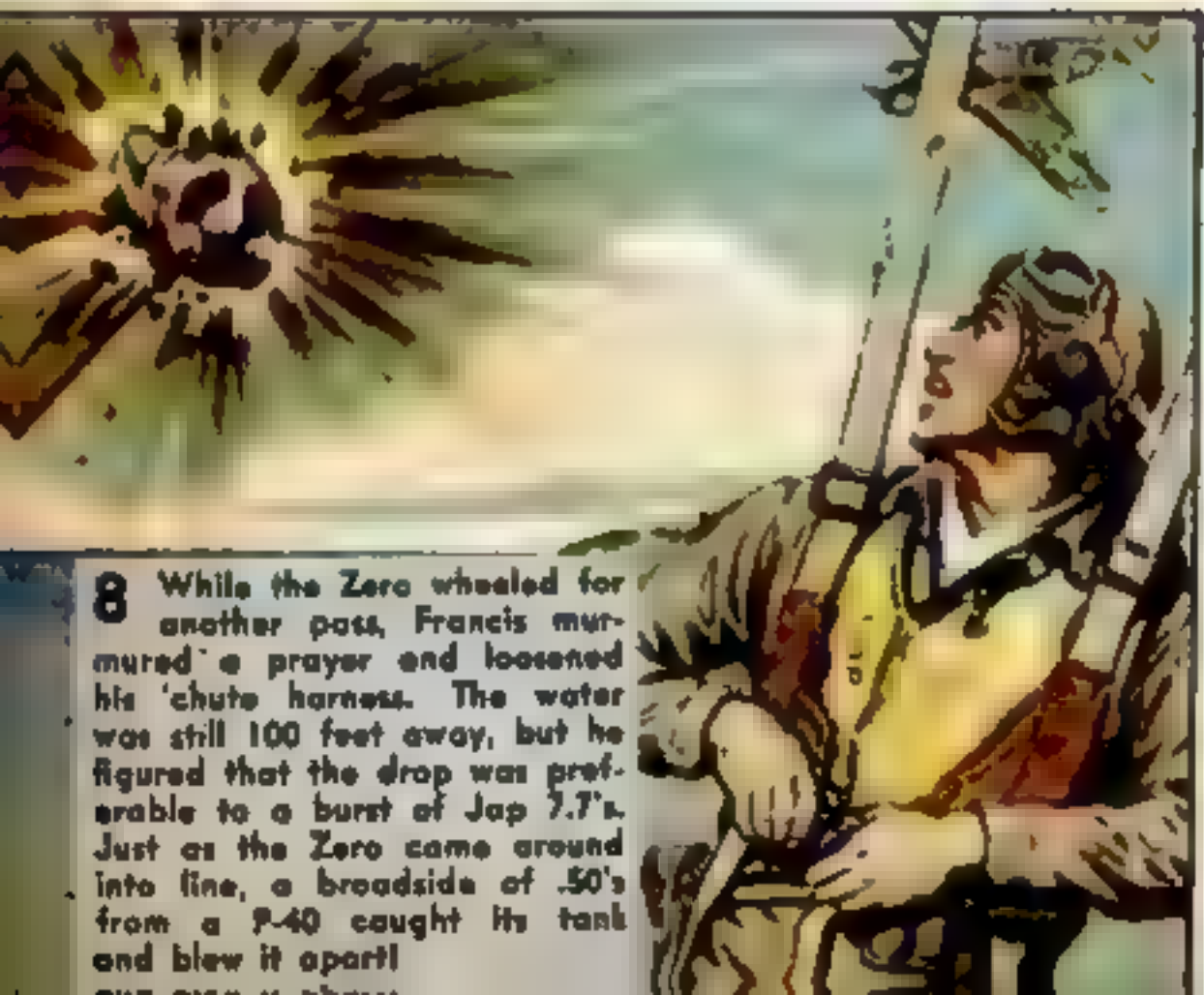
1 Itching for action, Lt. Mangus W. Francis took off with three other fighter pilots of the 13th Air Force on a routine combat patrol. Before the day was over, he had found plenty of excitement. Here is his story:



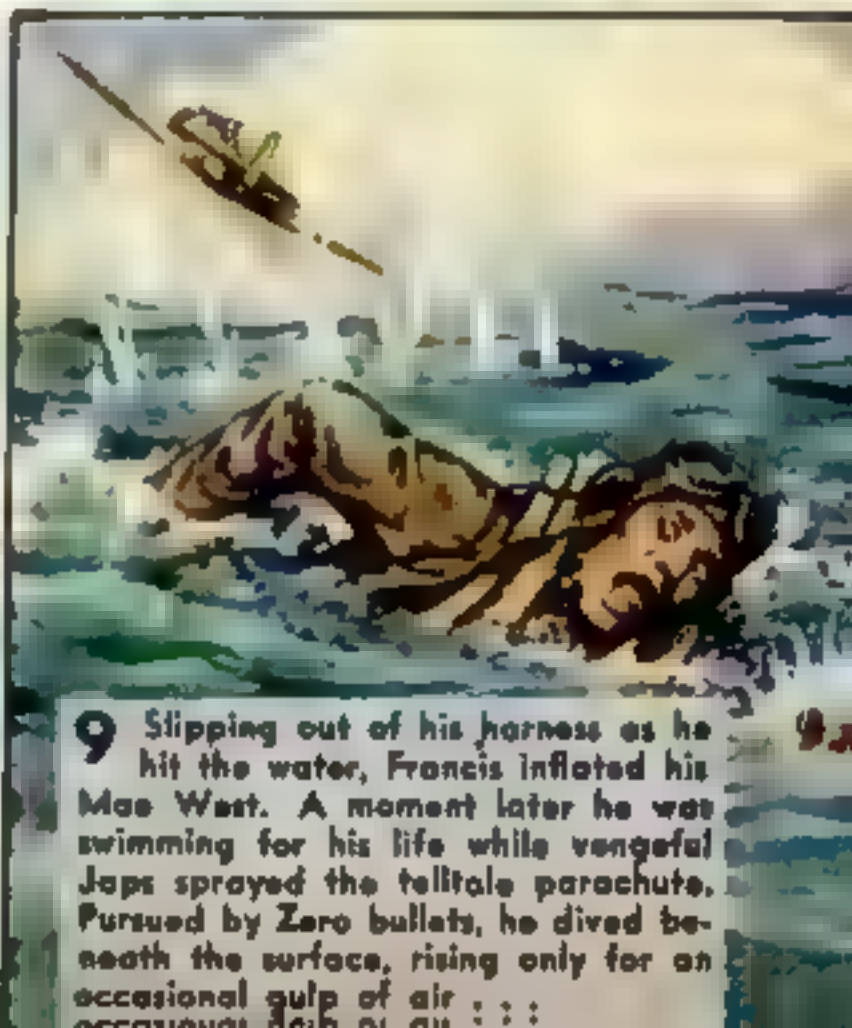
4 Then, about 5,000 feet below, he saw his pals ringed by a pack of Zeros! Standing the old P-40 on her nose, he yanked the throttle wide open. As he pulled out of his dive, a Jap jumped him from behind. Missing with his first burst, the Jap dived under the P-40. "The dope came up right in my cross hairs and I bore down on the trigger!" Number three!



5 Suddenly, the back of the bucket seat seemed to rise and hit Francis like a pile driver! A 105-mm. ack-ack shell had exploded just behind the plane, and a heavy chunk of steel had smashed into the armored backplate. The terrific force of the blow knocked Francis cold, and he made a one-point landing on the instrument panel . . .

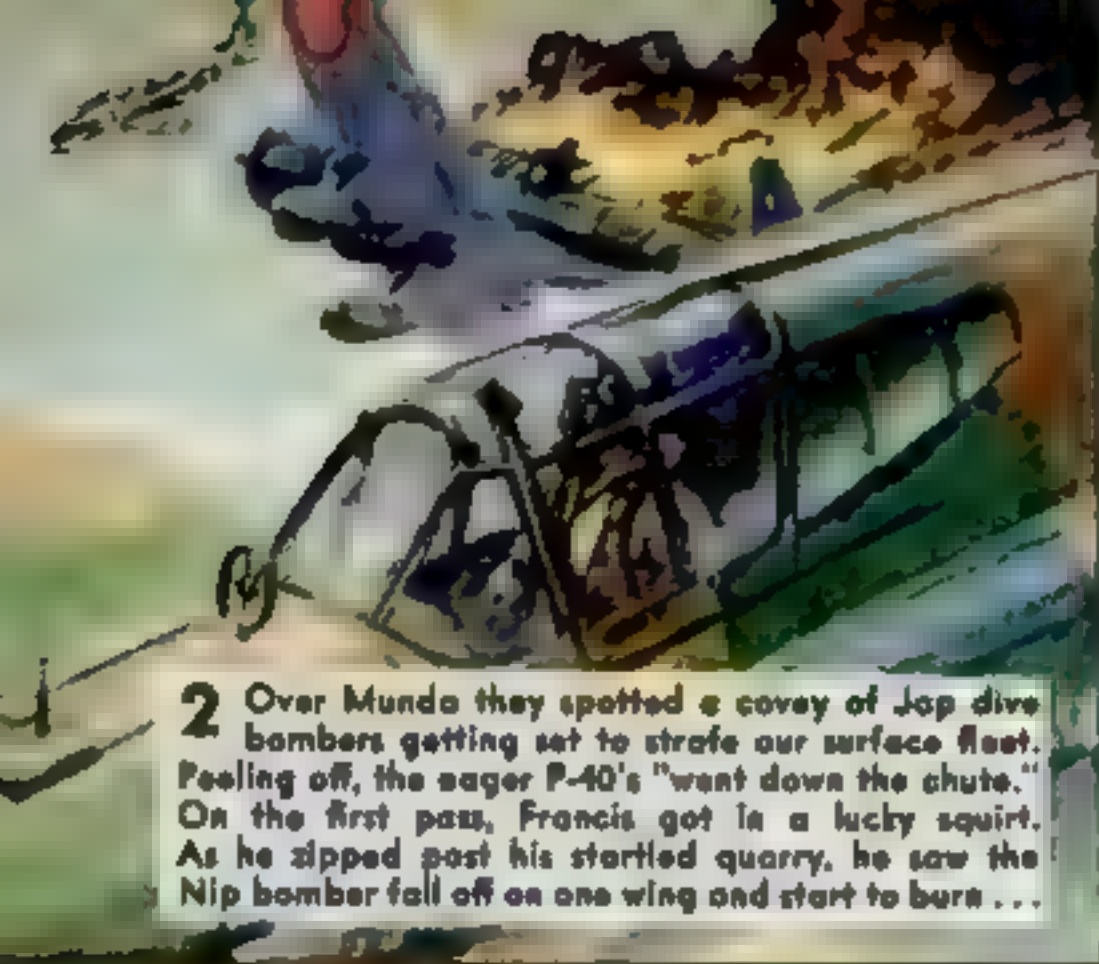


8 While the Zero wheeled for another pass, Francis murmured a prayer and loosened his chute harness. The water was still 100 feet away, but he figured that the drop was preferable to a burst of Jap 7.7's. Just as the Zero came around into line, a broadside of .50's from a P-40 caught its tank and blew it apart!

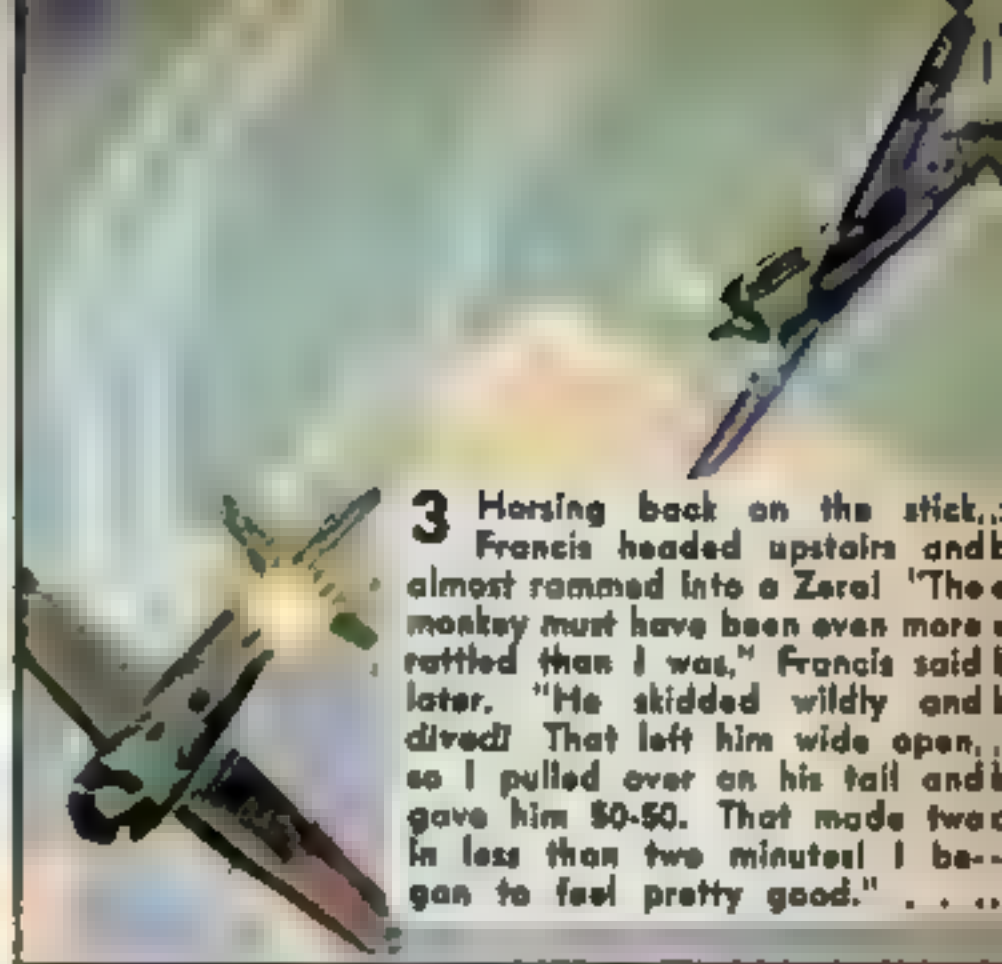


9 Slipping out of his harness as he hit the water, Francis inflated his Mae West. A moment later he was swimming for his life while vengeful Japs sprayed the telltale parachute. Pursued by Zero bullets, he dived beneath the surface, rising only for an occasional gulp of air . . .

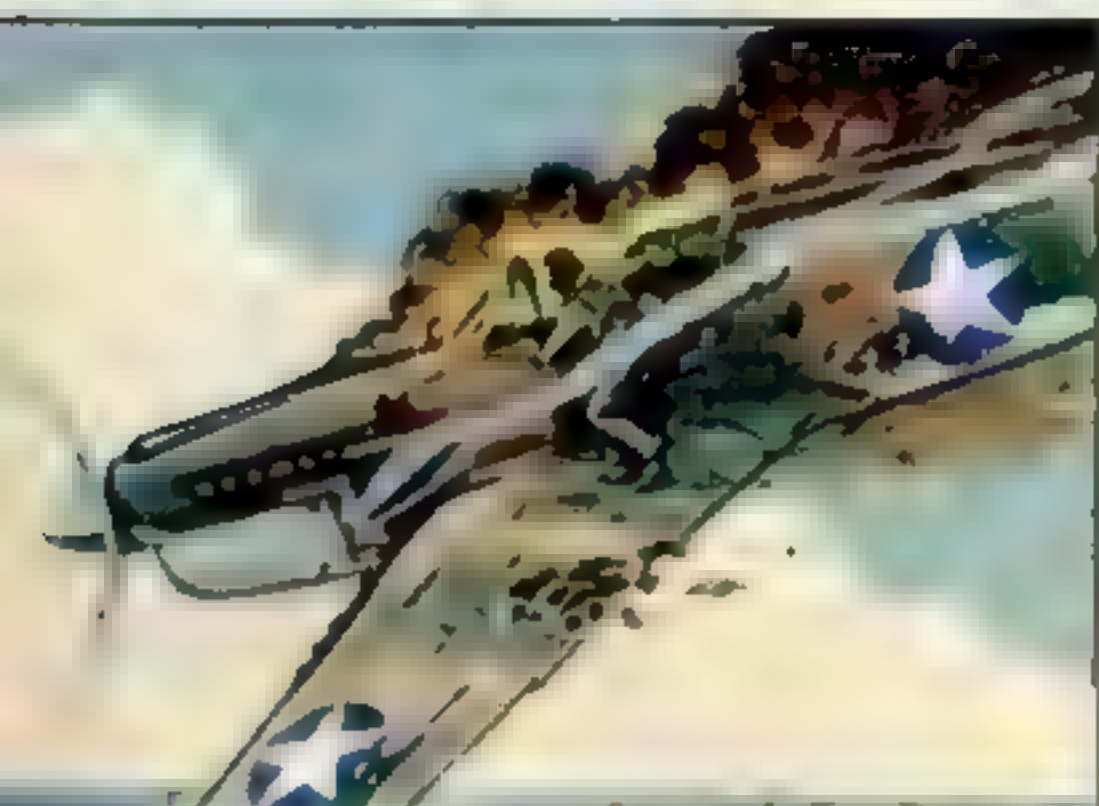




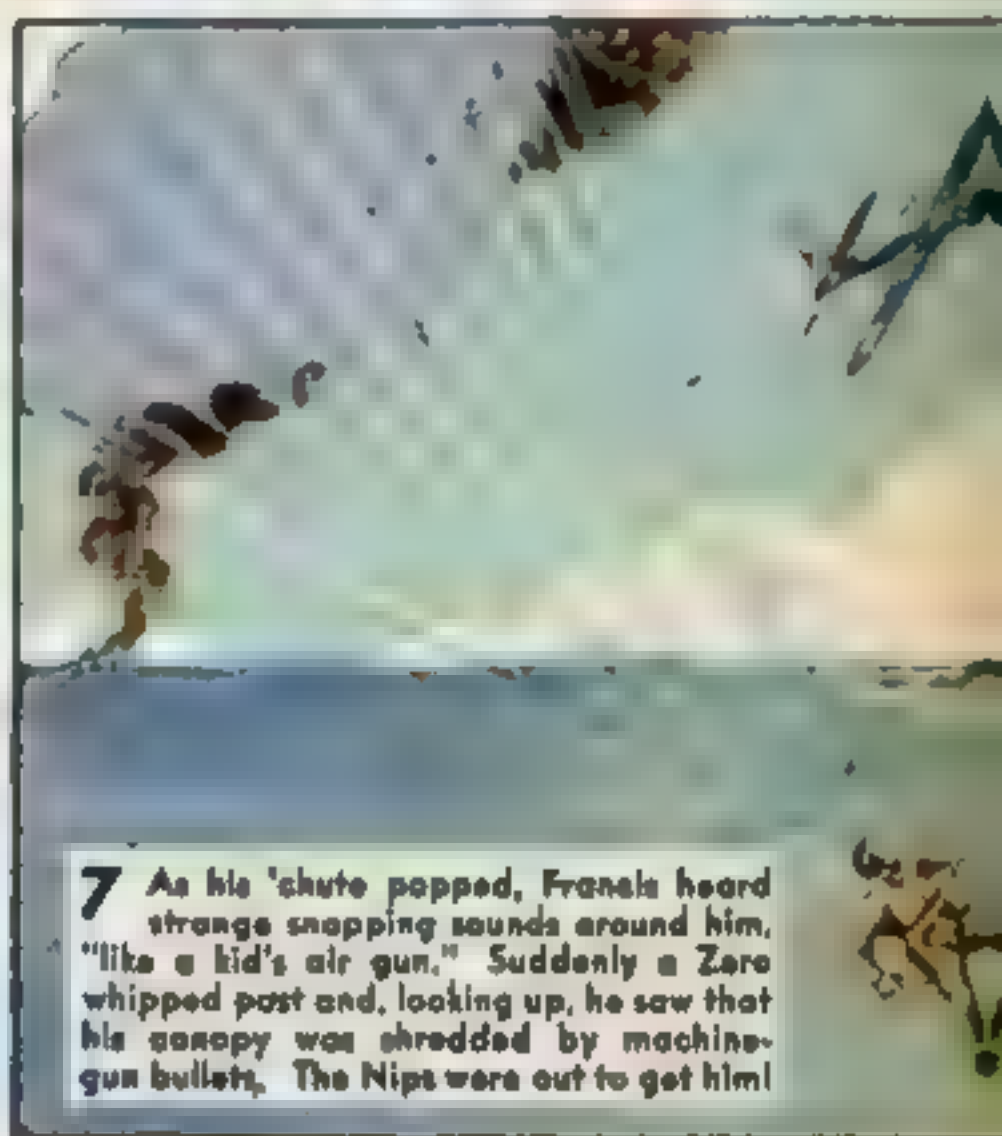
**2** Over Munda they spotted a covey of Jap dive bombers getting set to strafe our surface fleet. Peeling off, the eager P-40's "went down the chute." On the first pass, Francis got in a lucky squirt. As he zipped past his startled quarry, he saw the Nip bomber fall off on one wing and start to burn . . .



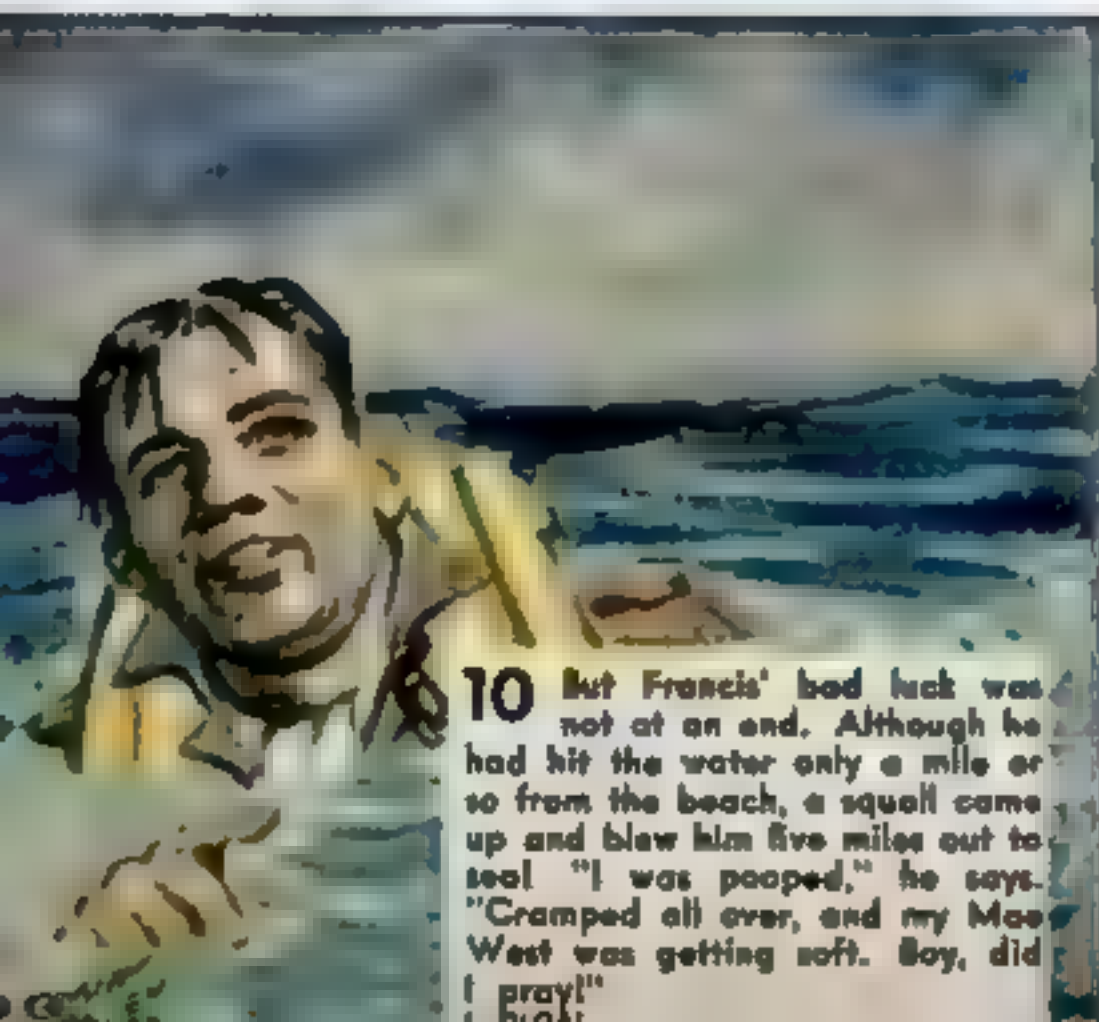
**3** Hanging back on the stick, Francis headed upstairs and almost rammed into a Zero! "The monkey must have been even more rattled than I was," Francis said later. "He skidded wildly and I dived! That left him wide open, so I pulled over on his tail and gave him 50-50. That made two in less than two minutes! I began to feel pretty good." . . .



**6** He came to with a mashed face and blackened eyes. The P-40 was a mess, and it obviously was time to kiss the old girl goodbye. Still dazed, however, Francis couldn't seem to make up his mind. In his own words, he "got set to jump, got in again, got out again." At last, with the sea perilously close, he hit the silk . . .



**7** As his 'chute popped, Francis heard strange snapping sounds around him, "like a kid's air gun." Suddenly a Zero whipped past and, looking up, he saw that his canopy was shredded by machine-gun bullets. The Nips were out to get him!



**10** But Francis' bad luck was not at an end. Although he had hit the water only a mile or so from the beach, a squall came up and blew him five miles out to sea! "I was pooped," he says. "Cramped all over, and my Mae West was getting soft. Boy, did I pray!"



**11** Four hours after he was shore down, Francis sighted a patrol plane which eventually picked him up. Now recuperating at a U. S. base, he is impatient for another crack at the Zeros. Strangely enough, he still craves action!

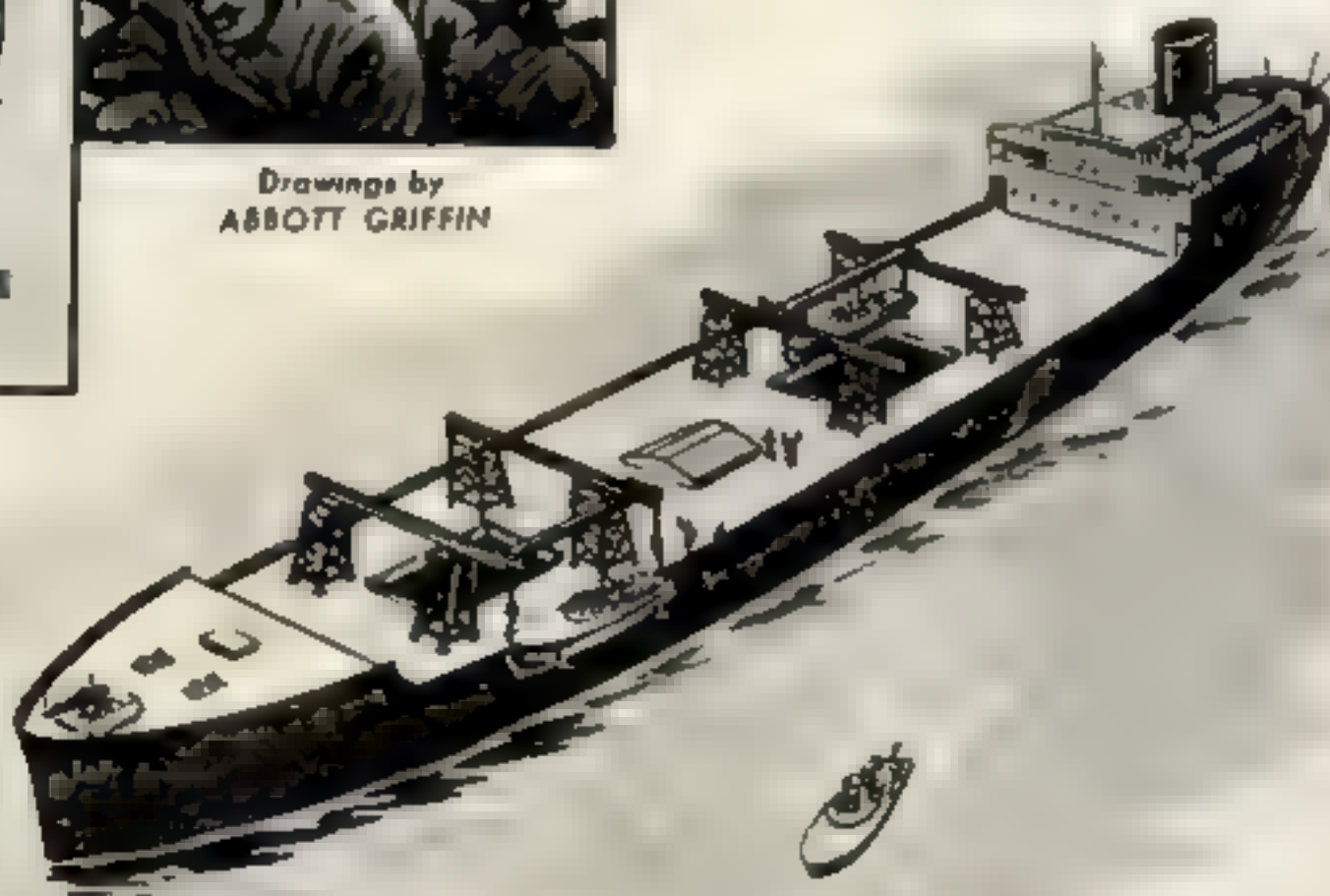


# war ideas

**BOMBS THAT RUN WILD** and create panic as well as destruction among enemy troops are the novel idea of S. L. Conrad, of Columbus, Ohio. Spherical in shape and provided with spikes with which to grip the earth, the bomb is dropped by parachute and then propelled over the ground by an internal gas engine mounted off center on a pair of free-swinging arms. Geared to a fixed center cogwheel, the engine, as it runs, constantly changes the center of gravity of the bomb and thus causes it to roll forward. Any variation in the contour of the ground will alter the direction. This, combined with a time fuse that can be changed periodically during manufacture, presents the enemy with the terrifying problem of trying to decide in which direction the fast-rolling bomb is going to move and when it is going to explode



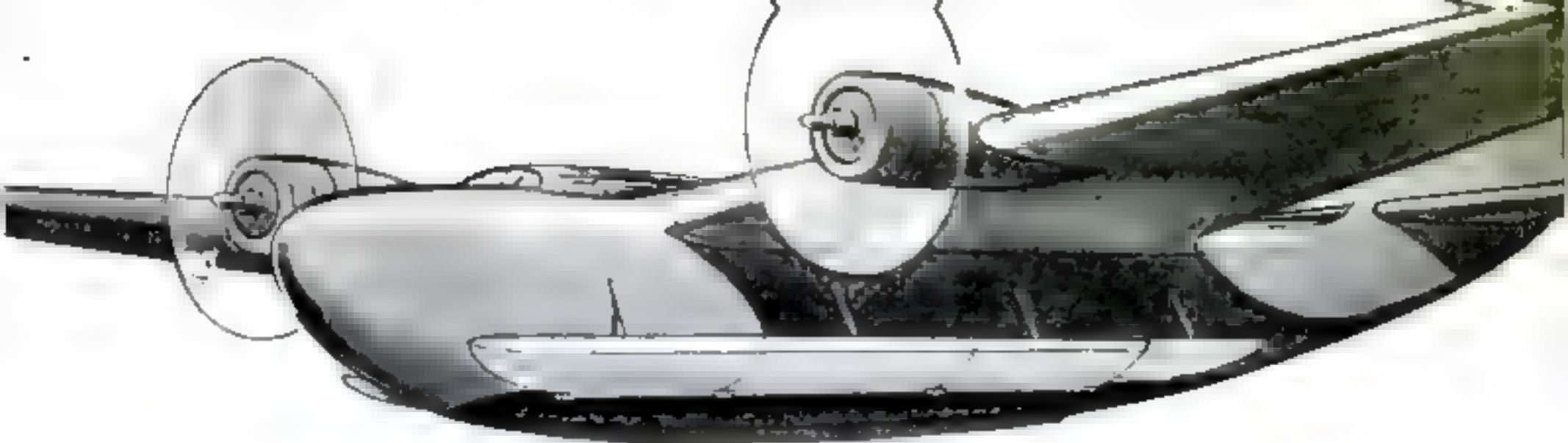
Drawings by  
ABBOTT GRIFFIN



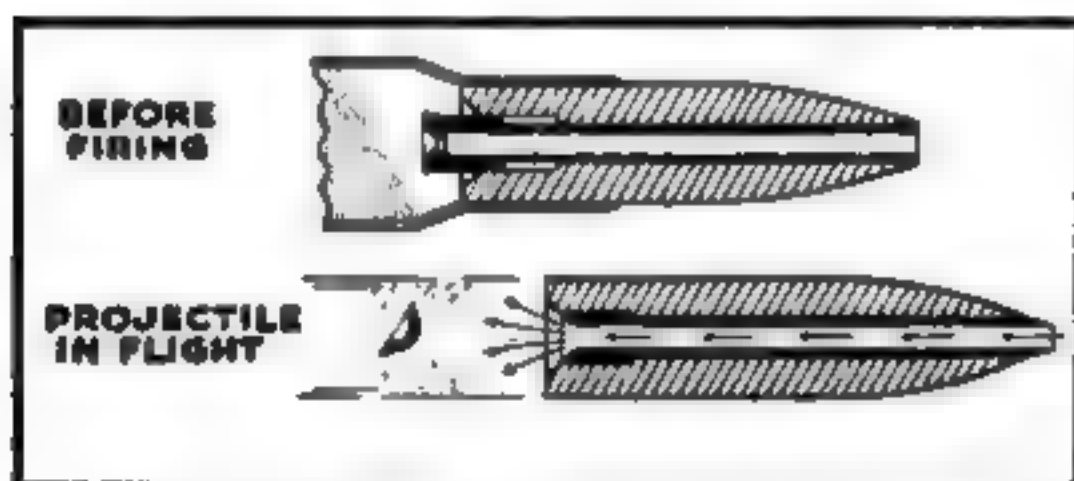
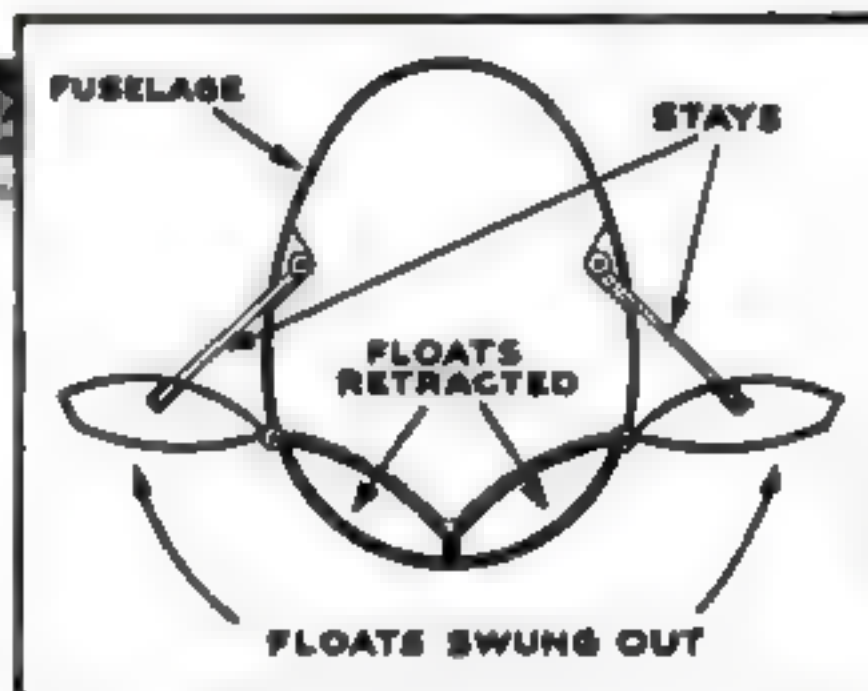
**PT-BOAT CARRIERS** that would operate in much the same manner as aircraft carriers have been suggested by Carl T. Forsberg, New York, N. Y. Stowed in the hold of a broad-beamed carrier, the swift and deadly little torpedo boats could be transported quickly to a battle area, where they would be lifted from the hold on central elevators, swung over the side, and lowered to the water by overhead-track cranes.

ABBOTT  
GRIFFIN



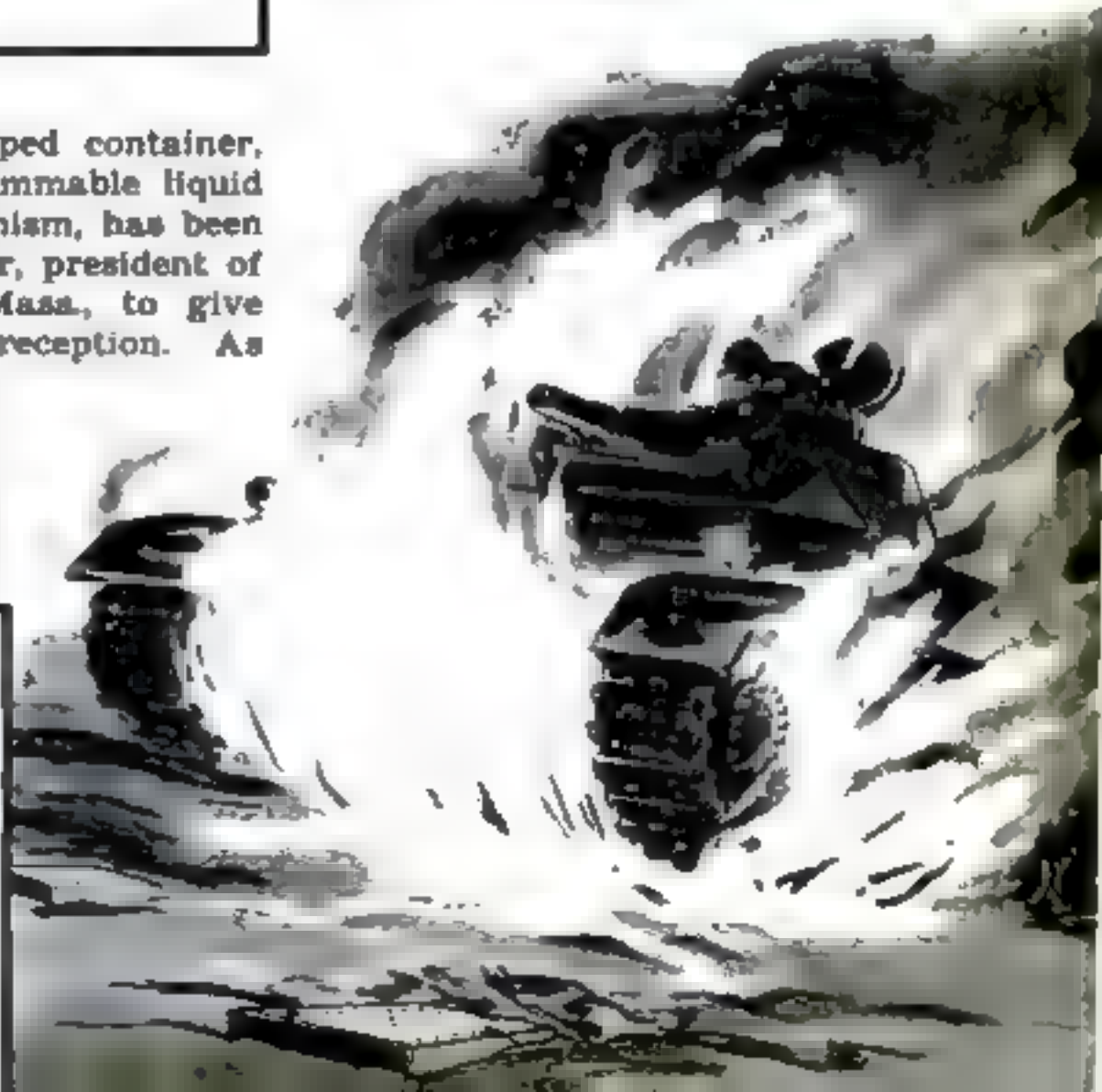
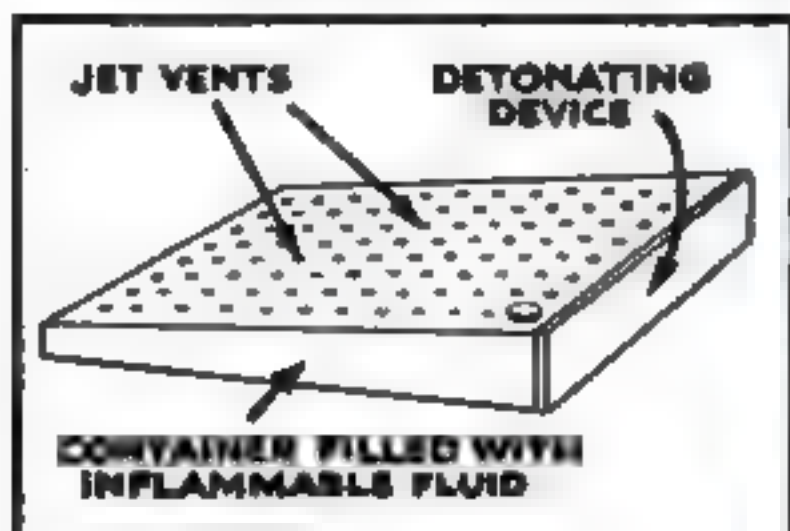


**RETRACTABLE FLOATS** that can be drawn up to fit snugly into the hull-like fuselage of a seaplane have been developed by the famous German aircraft designer, Claude Dornier, to avoid the terrific drag that the pontons impose on the plane once it has taken to the air. The floats swing on longitudinal hinges. When they are drawn up, the outline of the seaplane's fuselage becomes similar to that of a conventional land plane.



**HOLLOW BULLETS** are advocated by G. N. Albree, Winchester, Mass., to reduce the vacuum that retards other projectiles. A plug at the rear of the nose-to-tail tube breaks off with the explosion to permit a free flow of air through the tube.

**TANK TOASTER.** A wedge-shaped container, filled with gasoline or other inflammable liquid and fitted with an ignition mechanism, has been designed by Dr. Gleason L. Archer, president of Suffolk University, at Boston, Mass., to give advancing enemy tanks a warm reception. As a tank rolls over the container, it causes the gasoline to squirt upward through the container's jets, and at the same time sets off the mechanism that will ignite the fuel.





# Can You Recognize The Flags of Our Allies?

**U**NITED in common purpose, freedom-loving nations on six continents now carry the fight to the enemy. There is the most powerful union the earth has ever seen. Evidence of that strength flexes before us like a giant muscle. For added to America's own fabulous resources and manpower are those of big and little allies whose total populations approach a billion and a half and whose boundaries enfold 25,000,000 square miles of free lands—six times the size and population of territory in Axis hands. These nations are pledged to end international lawlessness, greed, and oppression. Their flags fly beside Old Glory. On these pages are the flags of the

United Nations, as of October 11, 1943. Each symbolizes our hopes for a better world. They are flags we should know at a glance. Unfortunately, not many of us do. When, for instance, Secretary of State Cordell Hull welcomed Iran into the ranks of the United Nations, few persons were familiar with the flag that became the thirty-third in that distinguished company. Few know that 18 of the Allied banners have red, white, and blue combinations, or that words are printed on five.

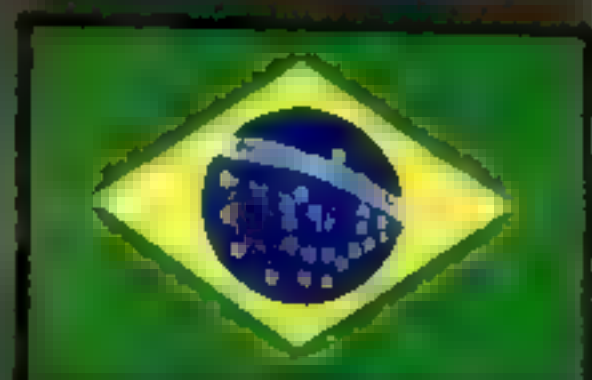
Study these flags of our friends and neighbors. When you think yourself familiar with all of them, turn to page 214 and test your knowledge.



AUSTRALIA



BELGIUM



BRAZIL



BOLIVIA



CANADA



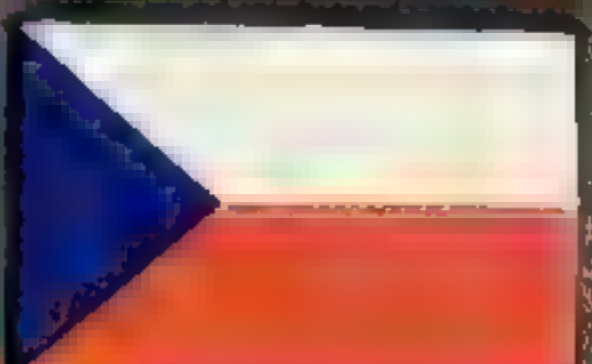
CHINA



COSTA RICA



CUBA



CZECHOSLOVAKIA



DOMINICAN REPUBLIC



EL SALVADOR



ETHIOPIA



GREECE



GUATEMALA



HUNGARY



HONDURAS



INDONESIA



IRAQ



ISRAEL



NETHERLANDS



PERU



NETHERLANDS



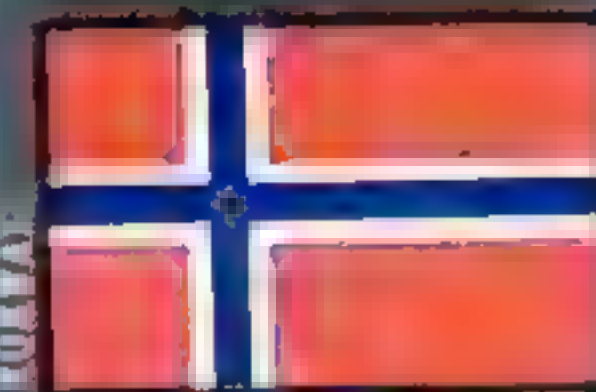
NEW ZEALAND



PARAGUAY



NORWAY



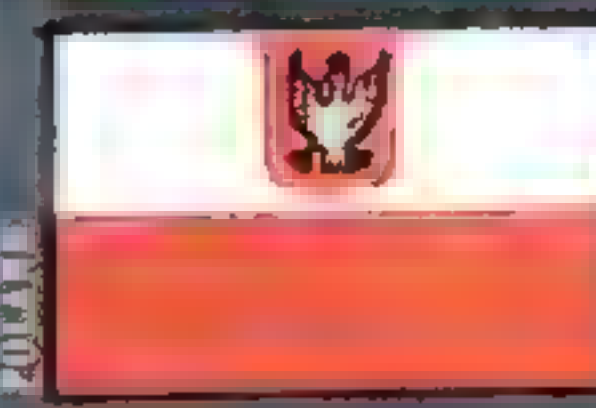
PAKISTAN



PHILIPPINES



PORTUGAL



ROMANIA



UNITED KINGDOM



UNITED STATES



USSR



YUGOSLAVIA



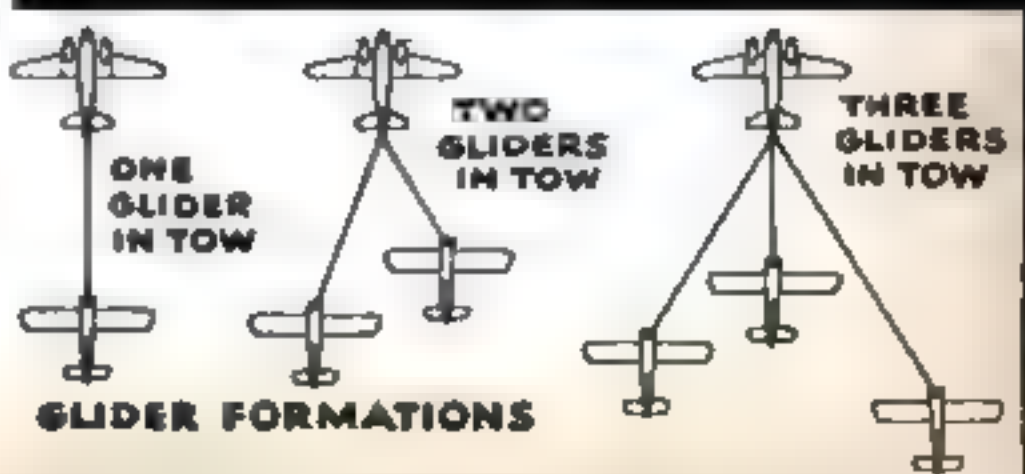
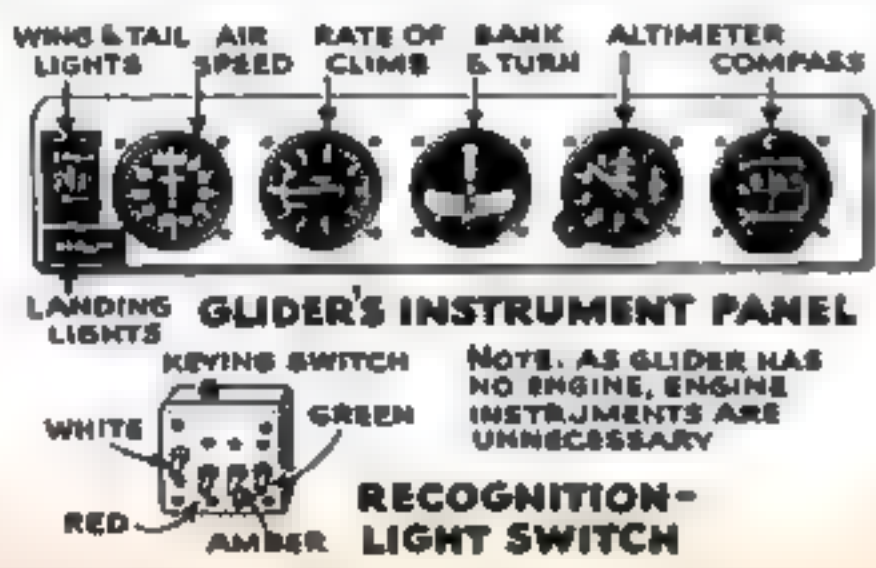
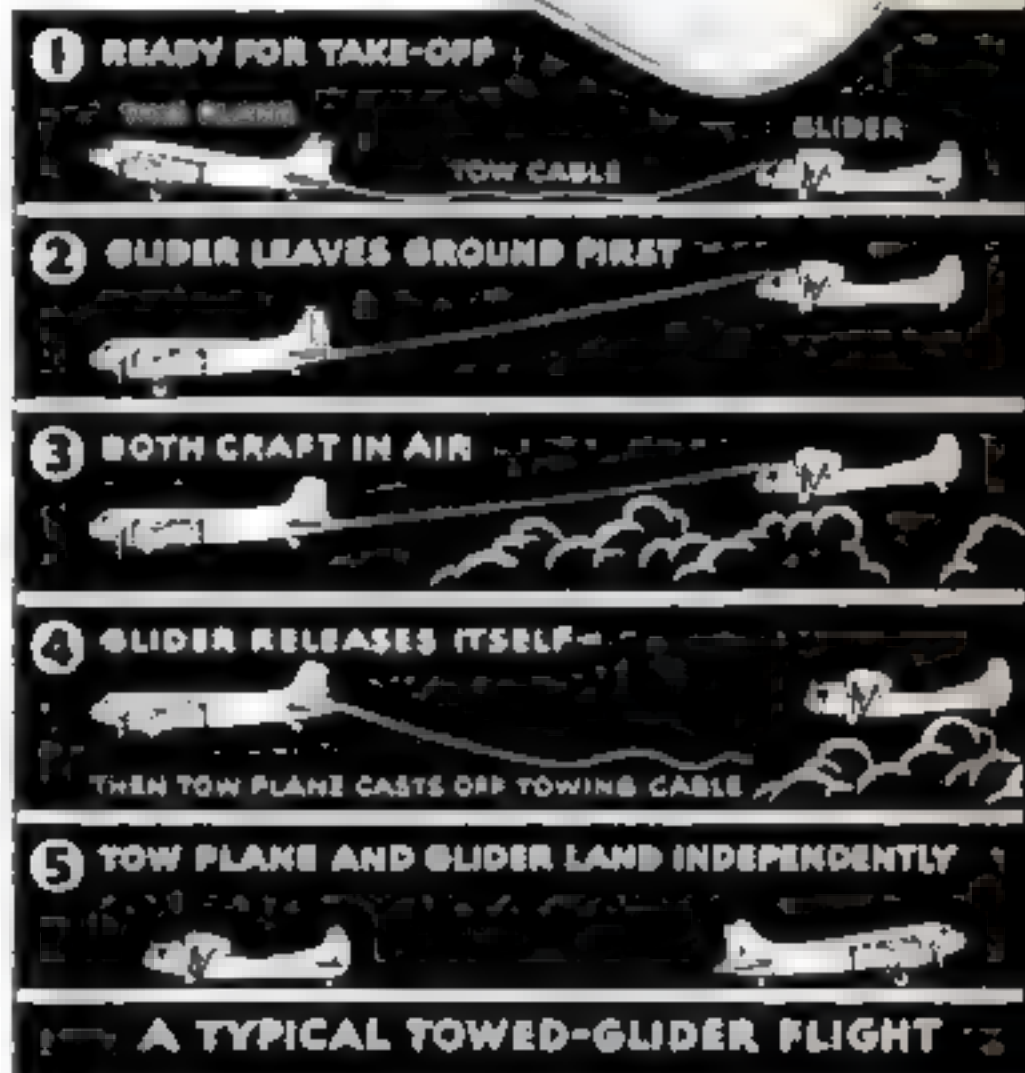
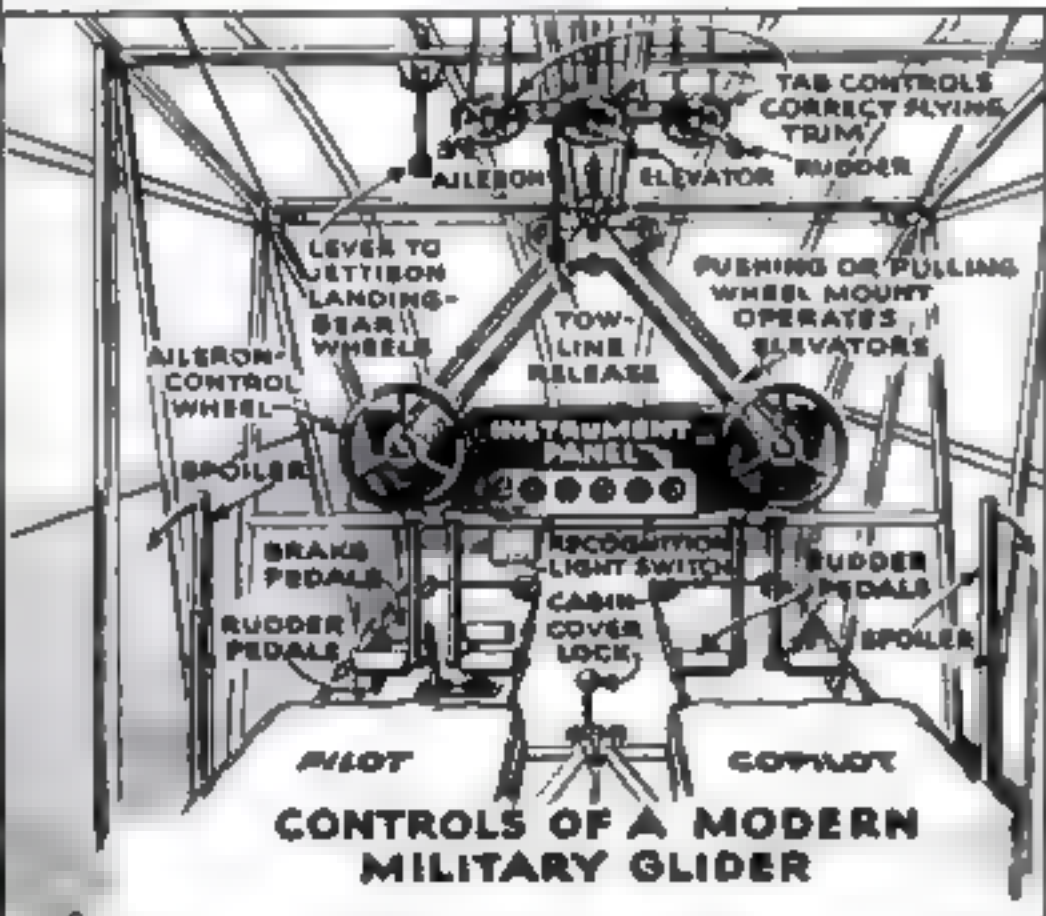
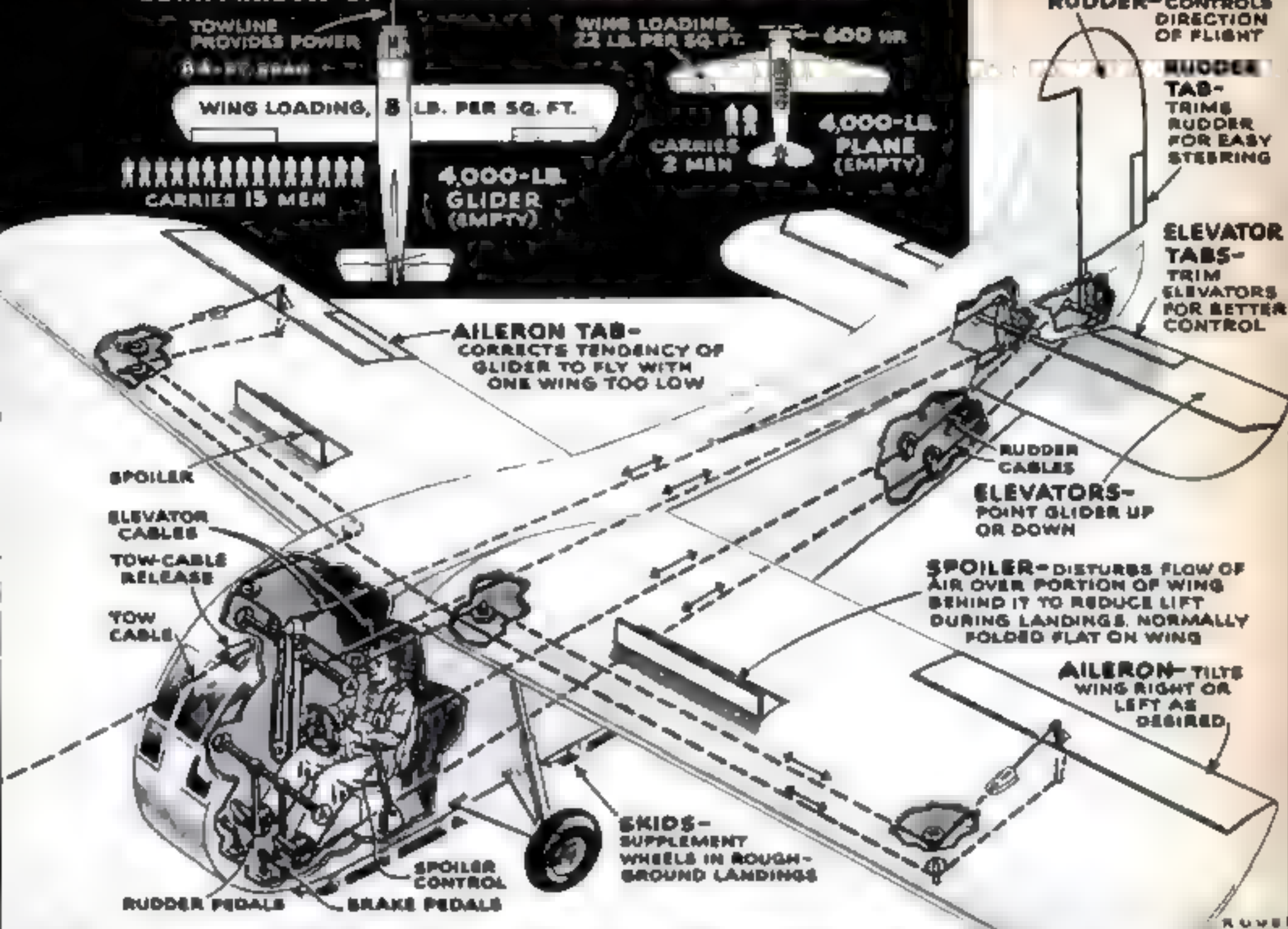




You have either reached a page that is unavailable for viewing or reached your viewing limit for this book.



# COMPARISON OF MILITARY GLIDER AND AIRPLANE







**TRAINING.** U.S. Army glider pilots master motorless flying in sleek training craft such as the two-place T6-4 seen above. With their long, narrow wings, our trainers are reminiscent of peacetime sailplanes. These Kodachrome shots were made by Robert F. Smith near the Wilmington, Ohio, glider field.

With its towline attached and the pilot in his tiny cockpit, the T6-4 below is poised for the take-off. Unlike sporting sailplanes, which depended on rising air currents to stay aloft, military gliders are towed to a point near their objective, then released. The elastic towline absorbs much of the shock at the start.









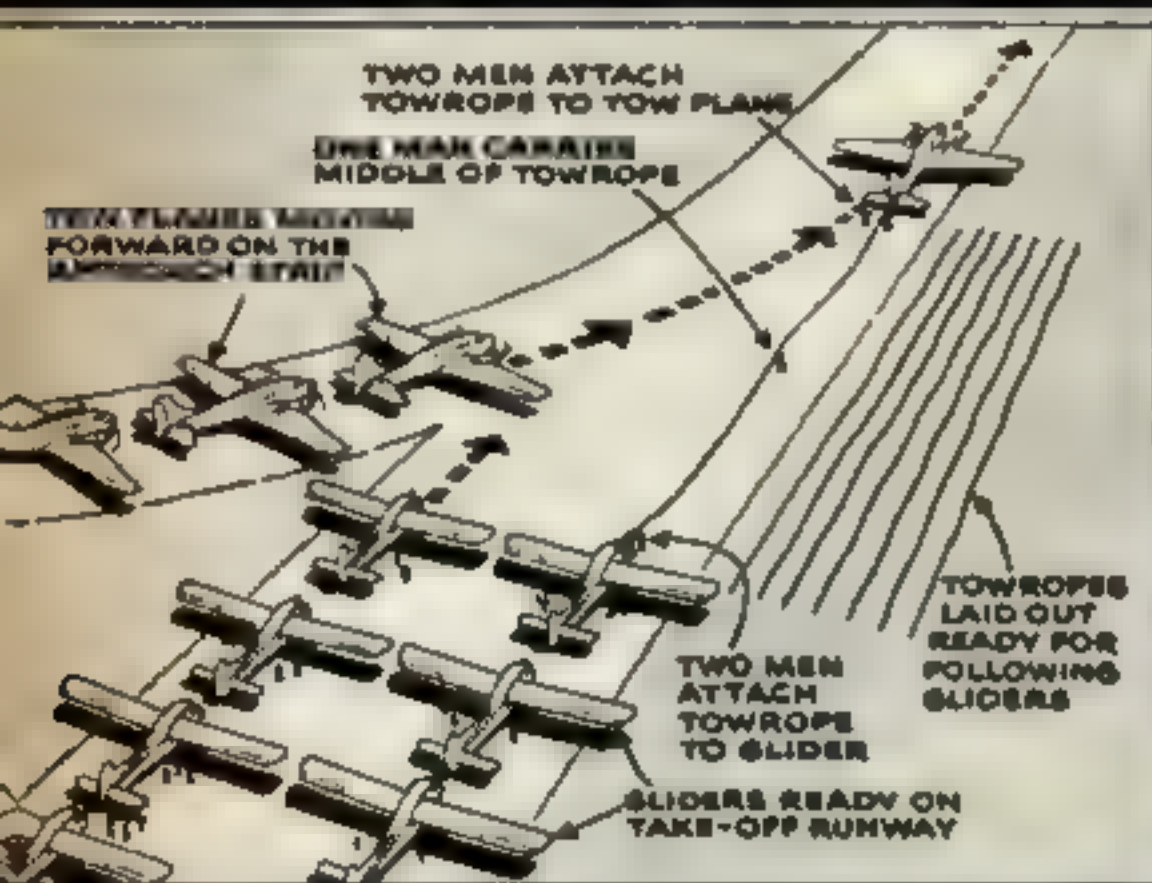


Towed by a tractor, a British Horsa goes back to its hangar after a flight. Wings and fuselage are mottled above, painted jet black below.

occupants to talk without raising their voices.

To lose altitude rapidly, the pilot raises a pair of solid flaps called "spoilers," which kill the lift of the wings. A spectacular innovation, illustrated on this month's cover, has recently been tested for checking a glider's forward speed. It consists of a horizontal parachute, unfurled from the glider's tail in midair, and released or retained as the craft strikes ground. With such quick-landing aids, a

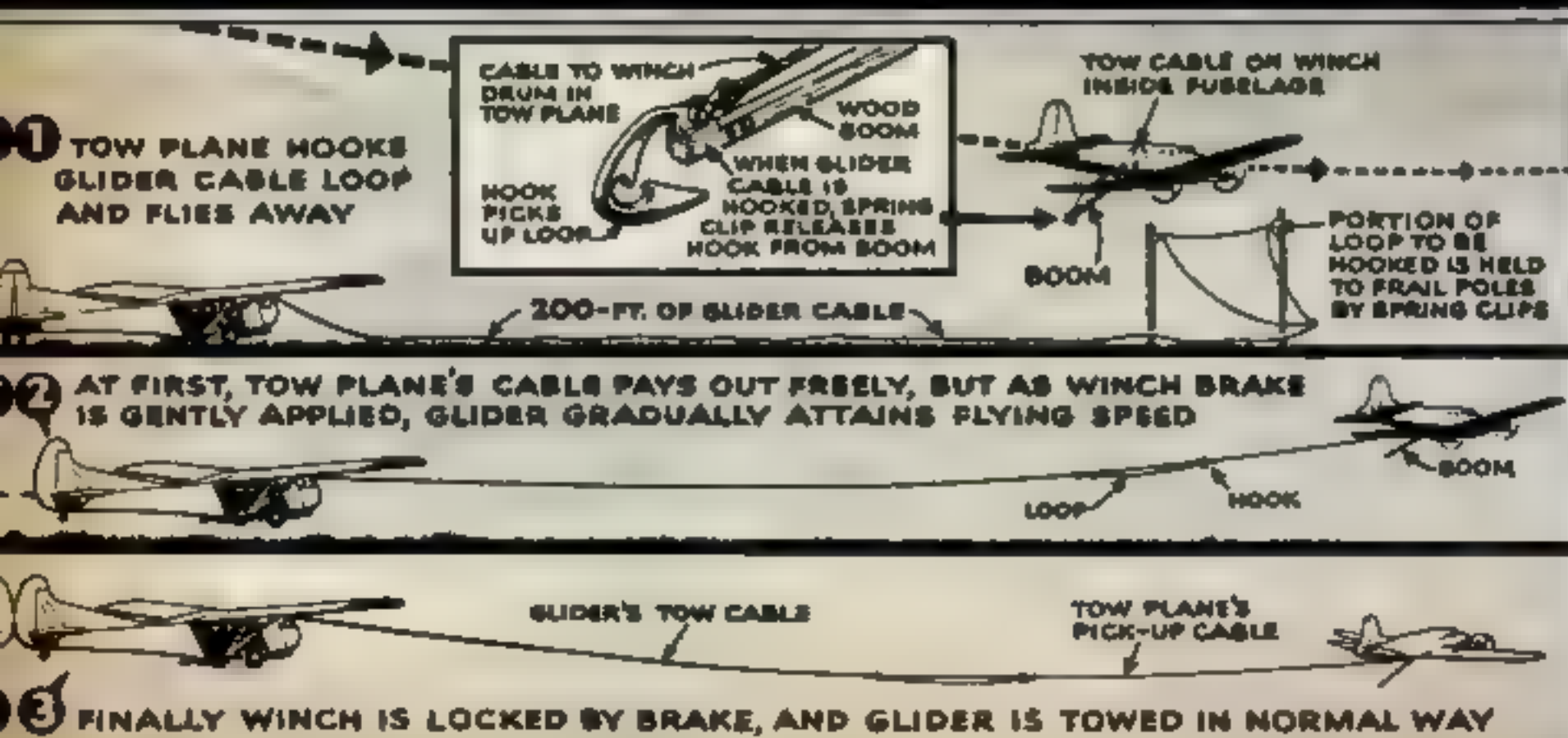
## SOME OF THE JOBS THAT GLIDERS ARE BEST FITTED TO DO



High-speed launching puts fleet quickly in air

Troops land in enemy's rear

Pickup recovers gliders from fields where tow planes cannot land





tree-skimming approach exploits the element of surprise to the fullest.

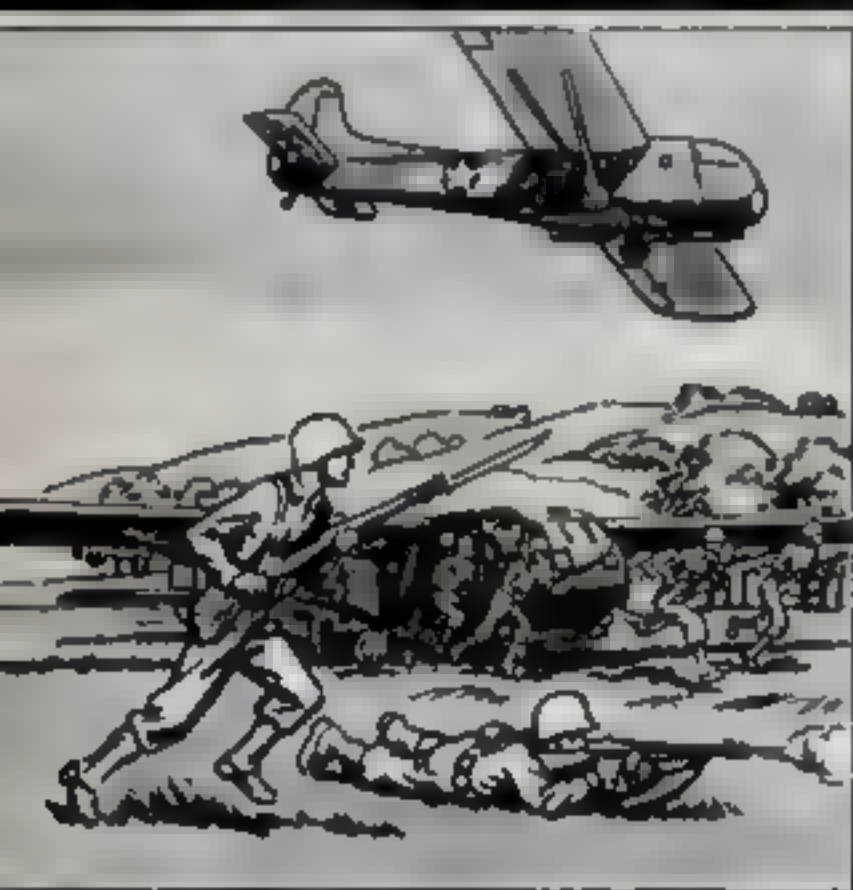
Glifters of the U. S. Army Air Forces now range in size from tiny, colorful training craft, called TG's, up to the big green CG-4A, which doubles as a carrier for troops and for cargo. Pending development of still larger and more formidable glifters, the CG-4A—currently in mass production—is the Army's standard type. As a troop carrier, it holds 15 men, including pilot and copilot. Alternatively, it transports a jeep and six men. Other cargoes may consist of 37-mm. antitank guns, 75-mm. pack howitzers, motorcycles, food, and ammunition. Overall, a CG-4A measures about 84 feet in wing span, and 48 feet in length. In addition to doors

at its sides, its whole nose may be opened to discharge men and equipment.

Military experience has demonstrated limitations as well as advantages of glifters. You can't get something for nothing by hitching a glifter behind a plane. It takes power to pull it. Trials seem to confirm the conservative opinion that, for long hauls, a powered plane alone will transport a load more efficiently.

Nevertheless, glifters appear destined to play an important role in commercial aviation, closely paralleling their special military advantages. Feeder lines, connecting out-of-the-way communities with through airways, can employ multiple glifter tows to pick up and let off passengers at any point along the way. (CONTINUED)

## AND HOW THEY ARE HANDLED IN MILITARY OPERATIONS

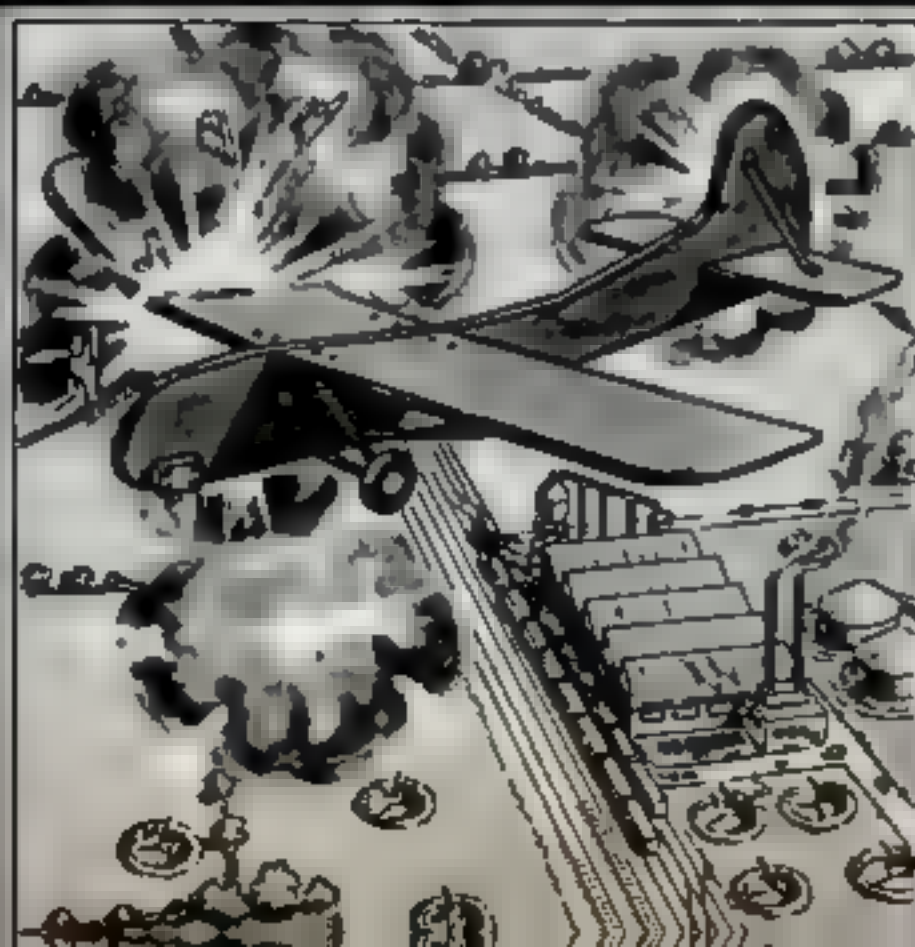


together, ready to fight

Jeeps, guns, and supplies carried to the front

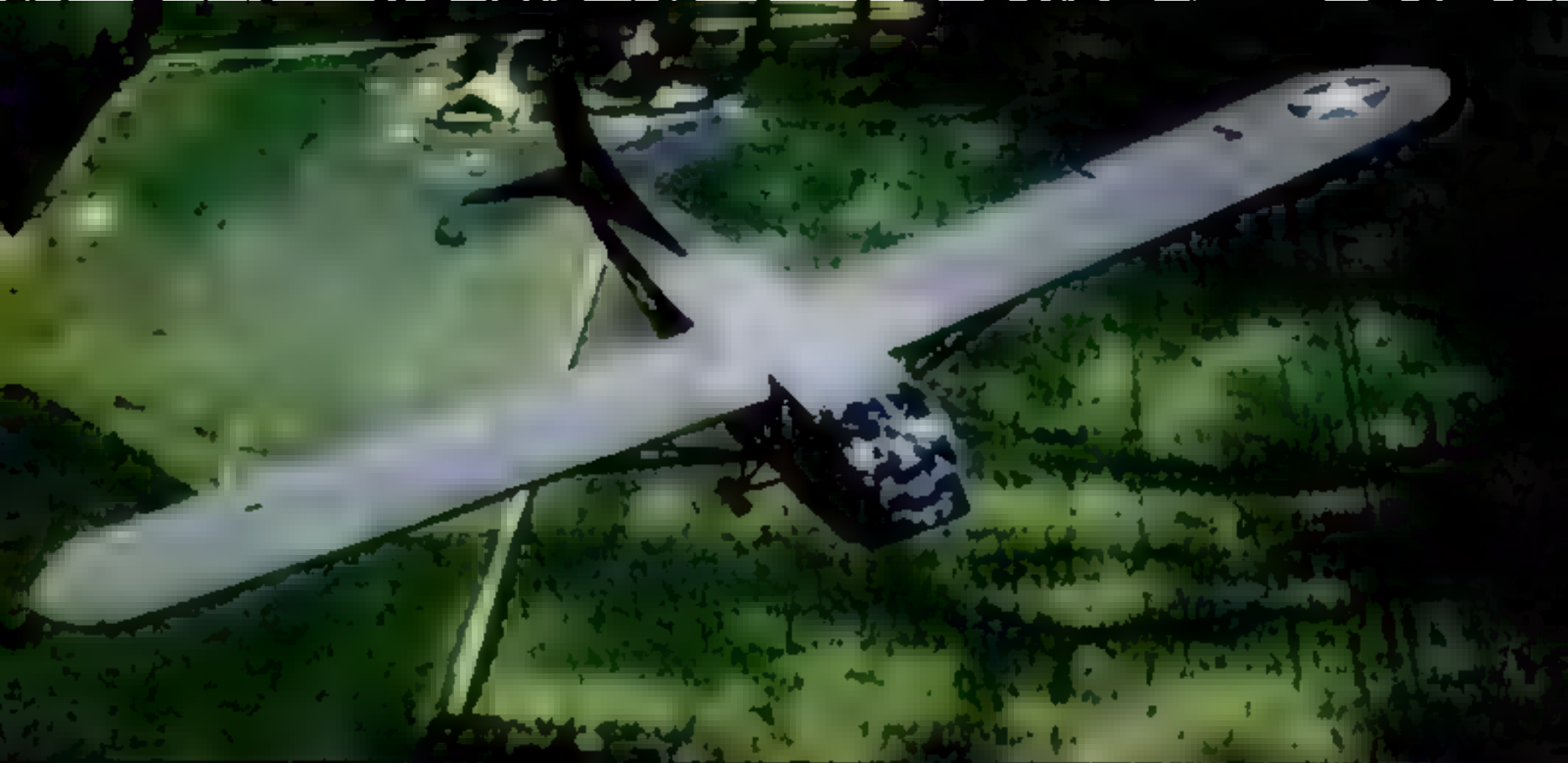
Glider models are targets for gunners

Wheels may be dropped by parachutes



STEWART ROUSE





CG-4A is the U. S. Army's standard troop and cargo-carrying glider. With a wing span of 83 feet 8 inches and over-all length of 48 feet, it weighs 4,700 pounds unloaded and carries a payload of about 1½ tons. Fifteen men, counting the pilot and copilot, can ride in its broad fuselage and come out fighting when it lands.

Pilot and copilot occupy a fully equipped cockpit in the blunt nose of the CG-4A. A broad, high window gives them full vision of what is going on in the air and on the ground during a tricky landing in enemy territory. In this photograph, the pilot is operating the lever that casts off the towline and releases the glider.

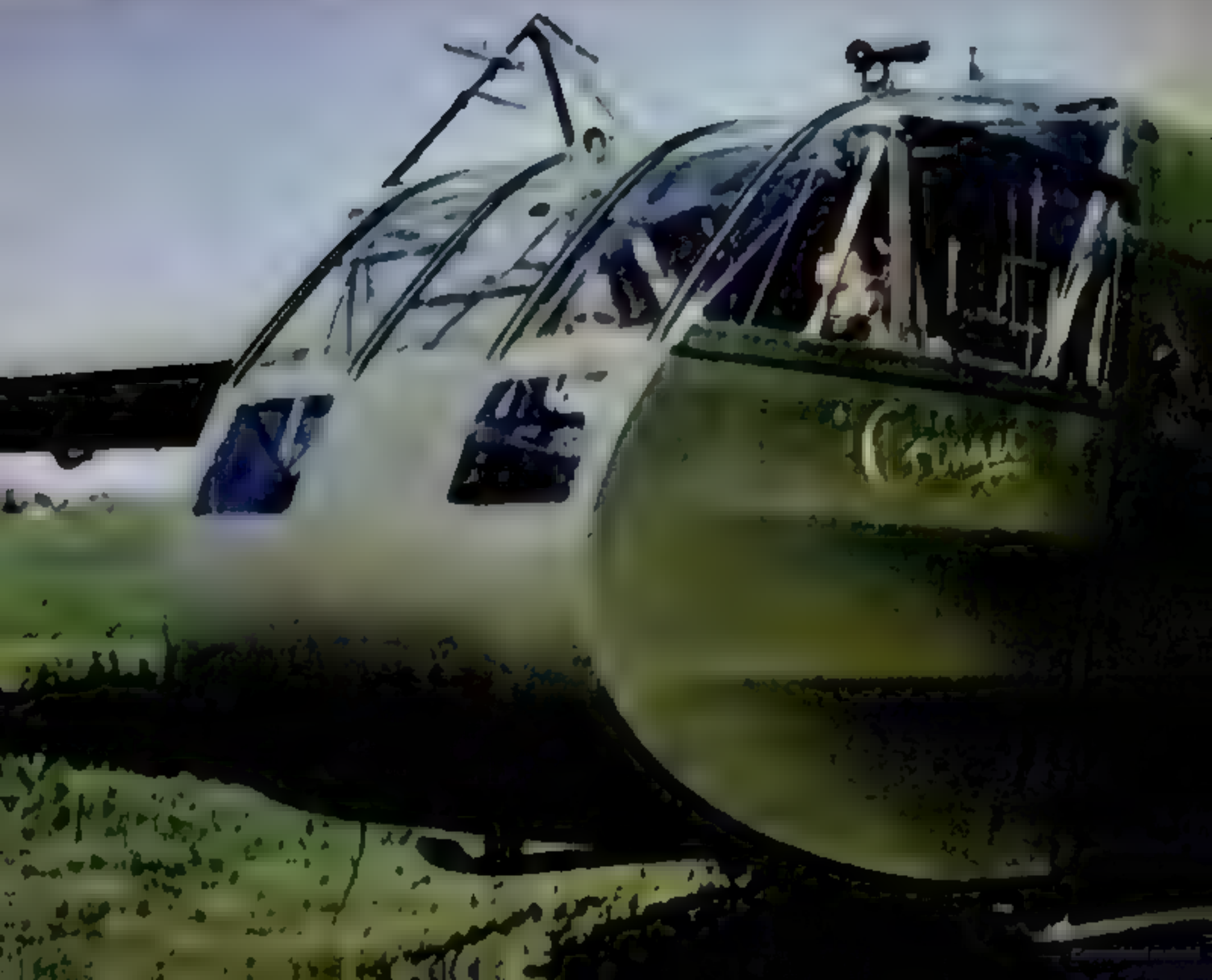






"PIG" is the Army's nickname for the powered glider, a hybrid craft produced by mounting detachable engines on a standard glider type. This is the PG-2, a CG-4A fitted with two 175-hp. air-cooled engines that can drive it at 100 miles an hour for delivery from factory without towing or knocking down

Landing gear consists of a pair of small wheels, which, on some models, can be dropped by parachute after the take-off. These are supplemented by a set of skids resembling sled runners, seen under the nose of the CG-4A below. The tripod on top is part of the mechanism for lifting the hinged nose





A "BAT PLANE," whose movable wings adjust themselves during flight to keep the craft from stalling or going into a spin, was recently demonstrated at the Dayton, Ohio, municipal airport. Operated by the control stick and held in ball-bearing sockets, the moving wings also help to keep the fuselage steady by absorbing air bumps. Other novel features are V-shaped wings, a nine-foot tall, and the elimination of elevators and horizontal stabilizers.



Because of priorities, Mallard carries overlight engine. Weights extending from wings were, therefore, used during tests to move center of gravity forward. Left, convertible cockpit covering is shown drawn up

The ship, known as the Mallard, was developed by George Cornelius, president of the Cornelius Aircraft Corporation, of Dayton. It is 17 feet long, has a 30-foot wingspread, and is said to be able to continue in normal flight even after the pilot has removed his hands and feet from the controls.



**FLYERS' SIGNPOSTS.** To simplify navigation for the thousands who are expected to fly their own planes after the war, Prentiss Cleaves, experimental test pilot for the Cessna Aircraft Co., of Wichita, Kans., suggests dotting the United States with markers set at intervals of 10 nautical miles to indicate the latitude and longitude of a plane's position. These markers would be 100-foot pylons painted orange so as to be plainly visible, and would carry huge numbers showing latitude and longitude in minutes. By noting the numbers on the nearest pylon, and then referring to an aeronautical map showing the locations of these markers, a pilot could quickly determine his position



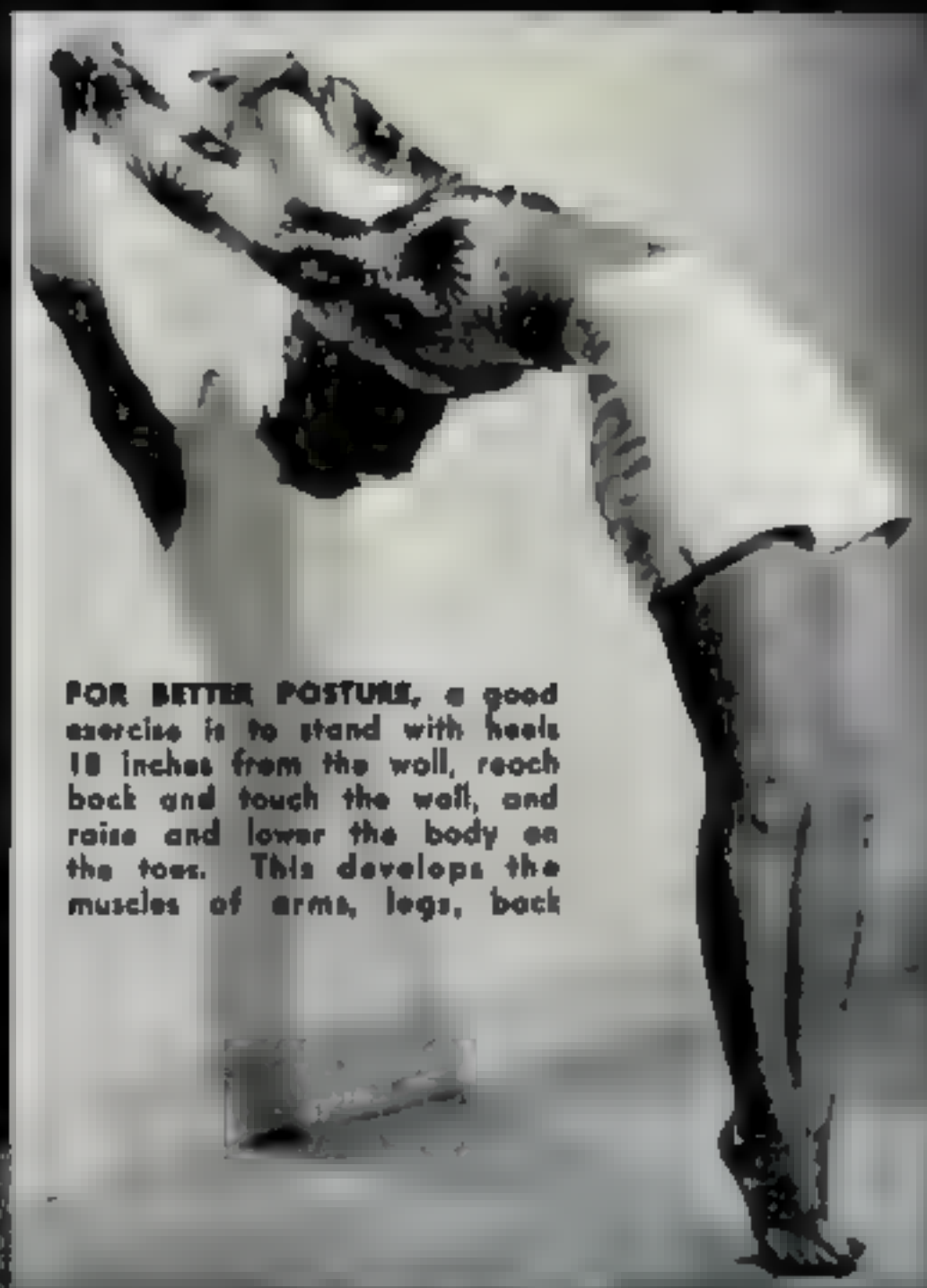
# Quick Daily Workout Guards Your Health

**W**HETHER you work in an office or a war plant, exercise in regular but moderate doses is as necessary to your health as a good diet. If you have a sedentary job, it will tone up your little-used muscles. If you are active most of the day, it will refresh those muscles that have become tired. Ramsey Ames, Universal Pictures actress featured in "Ali Baba and the Forty Thieves," shows you a 15-minute workout that you can take in your own bedroom. Take it easy at first, and then gradually work harder and harder at these exercises as you feel yourself limbering up. After each workout, lie down with your feet slightly higher than your head, and relax for 10 minutes.

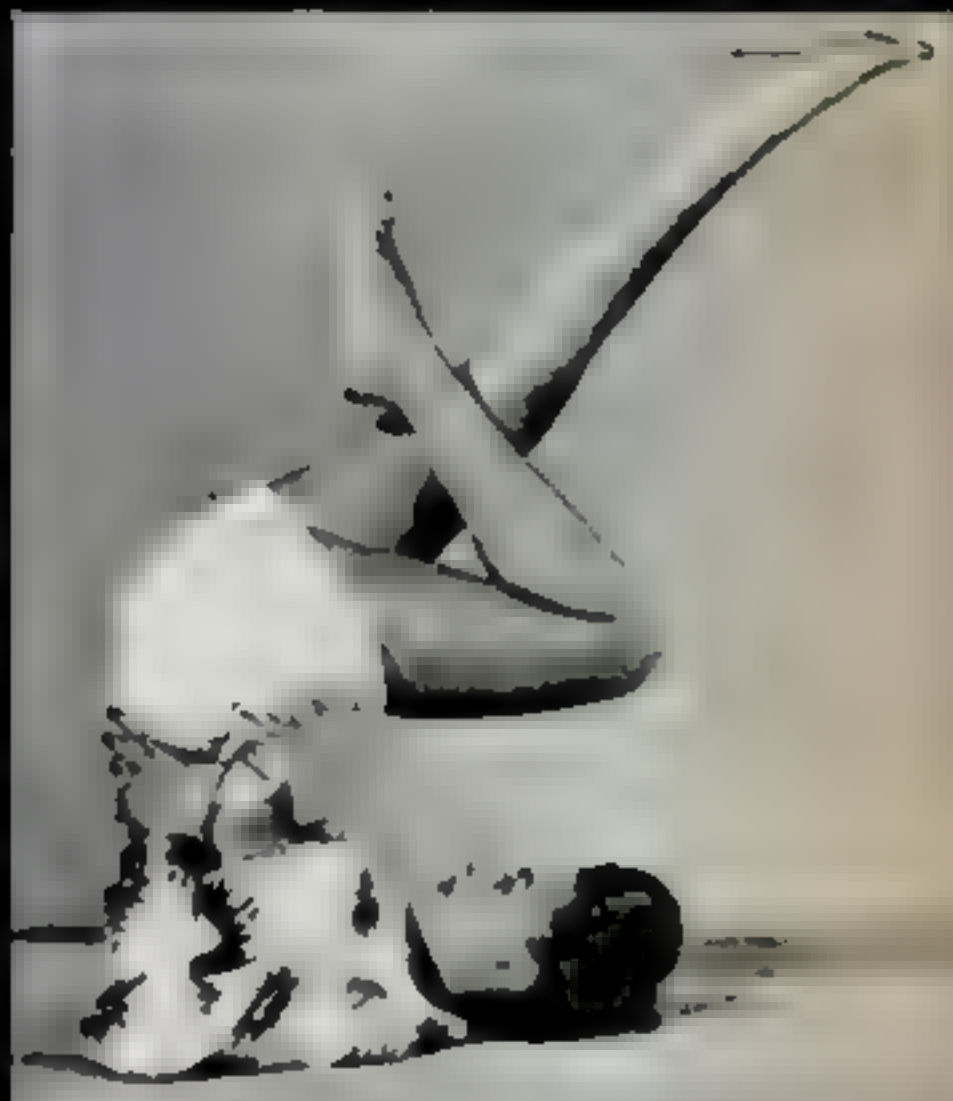


**FOR UPPER BODY,** keep fingers above the head, and alternately pull the hands against each other and relax. Do for only two minutes. Excellent for arms, chest, back, and shoulders.

**LEGS AND HIPS** can be given a good limbering up by rolling yourself up on your neck and then working your legs as if pedaling a bicycle.



**FOR BETTER POSTURE,** a good exercise is to stand with heels 18 inches from the wall, reach back and touch the wall, and raise and lower the body on the toes. This develops the muscles of arms, legs, back



**ABDOMEN AND BACK** can be exercised by lying with heels on edge of chair, and raising and lowering the body from the floor to position shown.







**FOR HEROISM.** This is the approved design of the Navy and Marine Corps Medal authorized by Congress on August 7, 1942. Awarded to "any person who, while serving in any capacity with the United States Navy or Marine Corps, including Reserves, shall have, since December 8, 1941, distinguished himself or herself by heroism not involving conflict with the enemy," it ranks immediately after the Distinguished Flying Cross among Navy decorations (P. S. M., July '43, p. 58). The ribbon is worn in lieu of the medal itself.



**THE "DRY GUILLOTINE"** does the opposite of making a soldier lose his head. It teaches him to keep it, and to hold it low when crawling into enemy territory under fire. Known as an infiltration trainer, the device has numbered vertical pegs that swing to a horizontal position when touched by a soldier who does not hug the ground closely enough. The trainee's score is computed by adding the numbers on the pegs he has tilted while crawling under the "bullets." A motto on the wicked-looking gadget gives this grim advice: "The higher your score, the deader you are."

**A COLOR INDEX** that aids in finding colors that match or harmonize has been brought out by the Container Corporation of America, of Chicago. Each of the index's six bakelite containers holds 14 celluloid cards, on each of which are eight removable plastic chips of harmonizing colors. The index also includes two work charts on which the chips can be placed, either in a circle or in a diamond-shaped arrangement, for purposes of comparison. The full range of the index is 680 colors.







Packing the biggest guns ever mounted successfully in aircraft, North American B-25 Mitchells are now blasting enemy tanks, ground installations, and warships with shells of full field-artillery caliber

**A**MERICAN planes now carry the aerial firepower to back up any plans our strategists may have for future air offensives!

Firepower, the peg on which air superiority hangs, has suddenly taken on new meaning for American planes and pilots. The reason is the achievement of a little group of Ordnance and Air Corps experts who have made a World War I dream come true—the dream of carrying aloft in aircraft regulation fieldpiece-caliber artillery.

Since the days of the Spad, the Camel, and the Fokker D7, the armament of mili-

# Flying Big Gun

America gets the world's most powerful air weapon—a cannon of fieldpiece caliber that goes into battle in a combat plane.





## HOW AIRCRAFT ARMAMENT HAS GROWN IN SIZE AND POWER

**.30 CALIBER** machine guns were the first real weapons mounted in planes. They were used universally in the First World War, both in fixed and in flexible mounting

**DAVIS CANNON** was a World War I stab at heavy caliber. Its strange double barrel, firing both ways, was designed for neutralizing recoil. A coaxially mounted machine gun helped in getting the range

**.50 CALIBER** machine guns, now our staple of aerial firepower, were first used in our B-17's in 1935. The American Browning in the .50 size has made air history

tary aircraft has undergone few really radical changes. The old .30 caliber machine gun has but recently given way to the .50 caliber gun developed by American experts and used by our pilots and air gunners. The first production air cannon firing an explosive shell was the 20-mm., only slightly larger in caliber than a .50 machine gun. Then came the 37-mm. cannon, around which the Bell Airacobra was designed. Some British planes now carry the 40-mm. cannon, only slightly larger than the Airacobra's weapon. These guns have proved highly effective, but our Ordnance men still dreamed of arming a plane with a weapon such as the most-used fieldpiece of World

War I, the French 75-mm. cannon.

Not until mid-November 1942 did their plans bear fruit. The setting was far out in the Pacific, off the California coast. A plank-and-fabric target bobbed in the surf directly in the glide path of a North American Mitchell bomber.

Suddenly, while the B-25 was still miles away, its nose blossomed orange flame. Gulls wheeling about the floating target took no notice, for before the sound of the gun could have reached them, they had vanished along with the target in a great upheaval of debris, water, and froth. America had a new aerial weapon—the world's deadliest aerial cannon, a flying "75"!

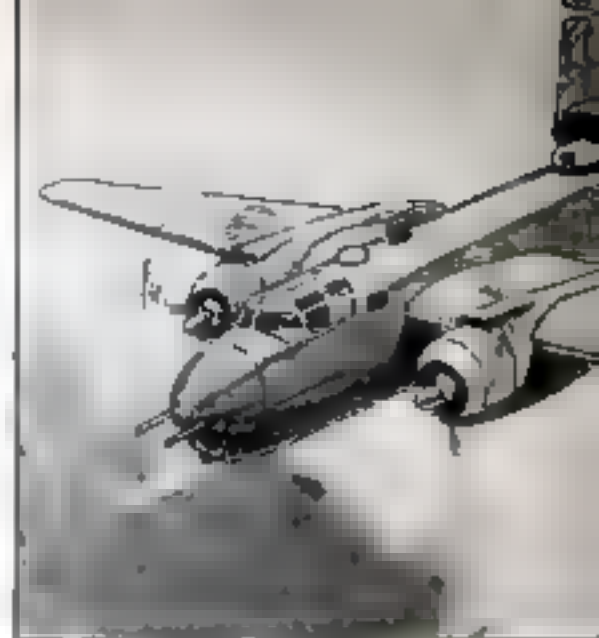
## THESE TWO MEN HELPED NURSE THE WINGED 75 ALONG



Jack Fox [left], North American Aviation service representative in the South Pacific theater, reported to his company on the manner in which the Mitchells stood up under the shock of big-gun fire in the early missions with the 75. Roger Rudd, below, is the test pilot who ushered in a new era in aerial firepower when he tried out the first B-25 installation off the coast of California. By a strange coincidence, he had been chief of a gun crew handling a 75 in World War I







## FROM THE DAYS OF WORLD WAR I UP TO THE PRESENT

**20-MM. CANNON.** This caliber, a favorite with foreign air powers, was put into our Lightning P-38 in 1941. It was the first air gun to fire explosive shells

**37-MM. CANNON.** Until now the second-largest aircraft gun (the British have a 40). The P-39 Bell Airacobra was literally designed around a specially built 37 with several machine guns

**75-MM. CANNON** mounted in the B-25 Mitchell medium bomber marks the realization of an air-ordnance dream—a gun of fieldpiece caliber borne aloft

In the cockpit of the Mitchell, lanky Roger Rudd, North American test pilot—and, by a coincidence, a 75-mm.-gun crew captain in the World War—relaxed his finger from the red button on his control wheel. With a grin he spoke through his throat mike to the ground:

"Rapping off over 200 in a mild glide . . . good husky jolt . . . scarcely any noise . . . she doesn't decelerate a damn bit!"

That was Rudd's report on the first production-model test of our new flying artillery.

Since this first flight, the flying 75 has appeared in ever-increasing numbers in the South Pacific and probably in other theaters. Its pilots came back from first missions with combat reports that read like pulp fiction, and with awe at what the new weapon had done.

One cannon-carrying plane on its first mission destroyed a Jap transport as it was unloading, and with one shell ended the earthly worries of 15 Japs scurrying up the beach. On its second mission it ploughed five shots into a large Jap destroyer, hitting the

aft turret, bridge, amidship section, and bow. Another run on it—now beached—plastered a stack, the bridge again, and the deck, and set off internal explosions. The third mission resulted in the blasting of runway strips and ground Jap planes, along with the silencing of reinforced pillboxes. The cost of all this was 90 rounds of ammunition and a few holes from flak.

Other planes flying the 75 had similar success, and pilots were jubilant over its effectiveness against any type of ground installation or mechanized equipment. One shell would completely destroy a light tank or put the heaviest out of commission. It was equal-

## A JAPANESE WARSHIP GETS A SAMPLE



This destroyer felt the might of the new aerial weapon when caught in a hail of 15-pound projectiles in the Pacific. The lower photo shows how she looked when the 75 got through with her



ly deadly against landing barges, ammunition dumps, locomotives, and power plants. The 75 has a range roughly the same as that of the original French 75, with the advantage of being fired from an elusive platform moving hundreds of miles an hour through the air. Such a gun, hurling 15 pounds of concentrated destruction from any angle in surprise attacks, does nothing to calm the nerves of the enemy, no matter how battle-tested.

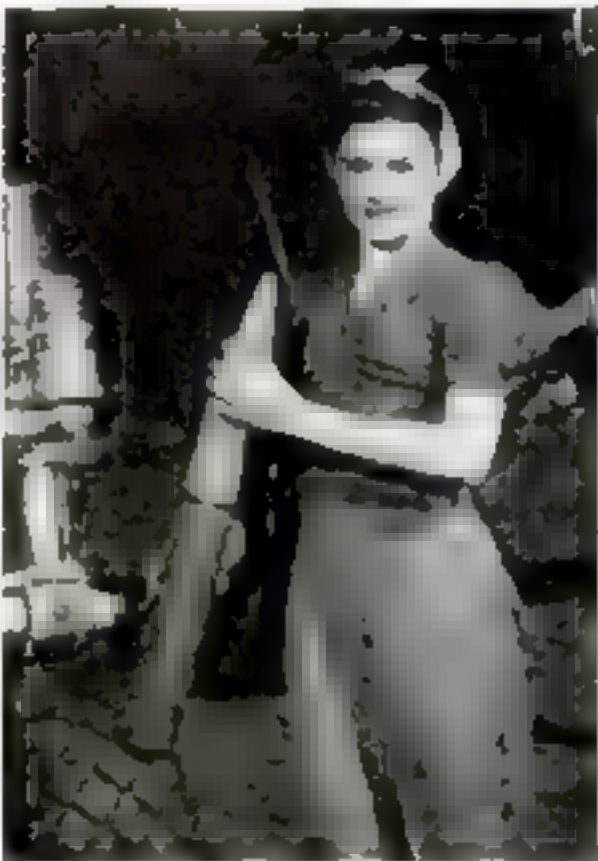
Even in World War I, a few experiments were made with heavy-caliber ordnance mounted in aircraft. One of the outstanding attempts was the Davis gun, a weird weapon that fired through both ends of the barrel. From one end came the projectile, while



The big gun frowns from a concave port in the lower left corner of the metal-clad nose section. Two .50 caliber machine guns are auxiliary armament

### WHAT THE 75 THROWS

FIFTEEN pounds of steel and high explosive are hurled by the winged fieldpiece at every shot. Complete shell, including projectile, case, and propelling charge, weighs 20 pounds and is 26 inches long. Below, a comely North American Aviation worker displays the new Jap chaser.



Shell for the flying 75 is compared below with those of other guns used in aircraft



from the other roared a charge of lead shot. Sandwiched in between was the powder charge. This crude arrangement was expected to overcome the major obstacle in mounting heavy-caliber artillery in aircraft—recoil. The Davis gun did overcome recoil quite effectively, but the back charge of shot had to be reckoned with when placing the gun aboard, and the two-way shell was clumsy to handle. A .30 caliber Lewis machine gun was mounted atop the contraption and fired when approaching the target. Tracers from the Lewis determined when the cannon was within range of its objective, for the range of the double-ended charge was roughly the same as that of the machine gun.

Eventually, the Davis gun was abandoned as an aircraft weapon, and recoil remained a stumbling block until American ingenuity surmounted it many years later.

Shortly before 1939, first tests were made with an old-style French 75 under the direction of Captain (now Colonel) Horace A. Quinn, who was put in charge of the project as Chief of the Aircraft Armament Development Section of the Technical Division, Ordnance, under *(Continued on page 222)*



Folding bicycles provide transportation for paratroopers where gasoline is not available for the motor scooters (right)



**LIGHTWEIGHT** motor scooters and bicycles, dropped along with Allied parachute troops, enable the men to go places and do things in a hurry. One man can easily lift the scooter from its container, as shown above. Where gasoline is hard to get, folding bicycles may quickly be unlimbered.

**A MIDGET BLOWER**, weighing only two ounces, now serves to carry excess heat away from electronic tubes in space-saving war equipment. Alternately, a universal back plate permits the cooling device to be fitted to an electric motor of nearly any design. Despite its tiny size, the blower moves 15 cubic feet of air a minute at 3,000 revolutions a minute. Measuring 1½ inches in diameter, its steel blower wheel is plated with cadmium metal to resist corrosion.



**POWDER-PUFF AND GIFT BOXES** have been transformed into first-aid and ration kits, to meet the needs of U. S. paratroopers. Adoption of a rigid plastic, and improved mass-production methods, accomplished the urgent change-over. The round medical kit nests within a frying pan,

and the oblong ration box contains concentrated food, bouillon powder, a supply of chewing gum, and a water bag.





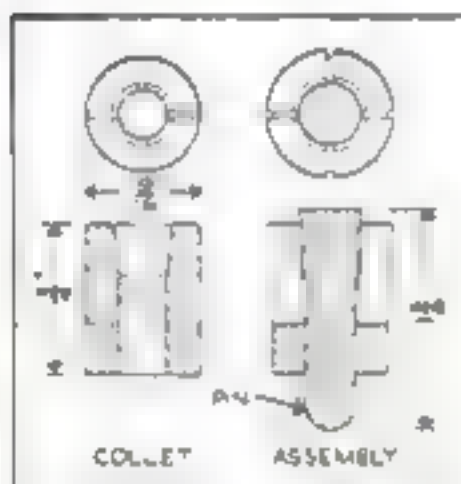


**WAR MAPS** made from aerial photographs are matched accurately with existing charts by the aid of a new "zenith camera" designed and produced for the Corps of Engineers by the Eastman Kodak Company, Rochester, N. Y. Set up at some recognizable point within the area being mapped, the three-unit outfit is operated at night to photograph the sky directly above the point of observation. Its pictures show the stars surrounding the zenith, together with a record of the exact time of exposure. With the aid of a catalog of the stars, the latitude and longitude of the point of observation can then be computed. Accuracy of the results obtained is believed to be within 40 or 50 feet.

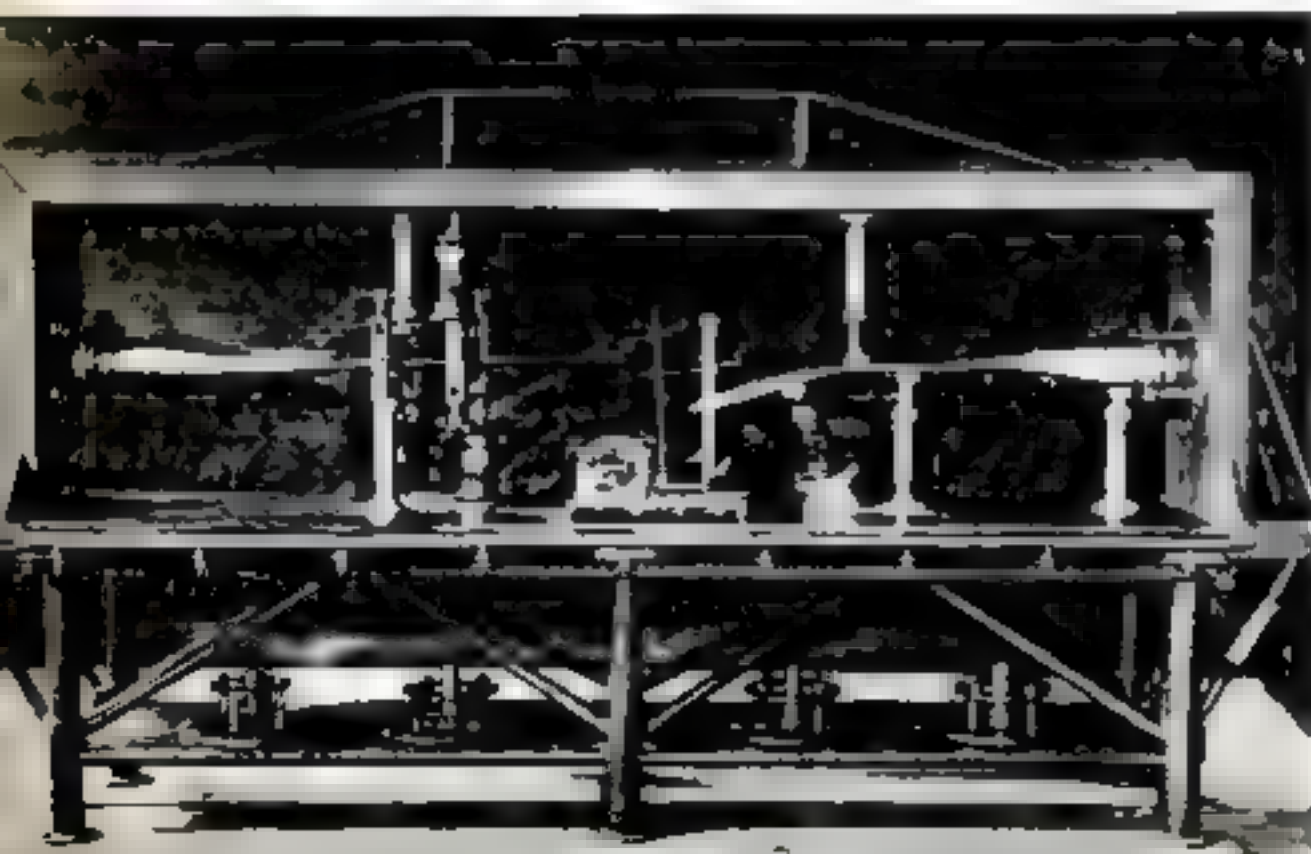
**NO NAILS** are needed in the assembly of a reusable apple box developed by the U. S. Department of Agriculture. Wooden collets set into the edges of the end pieces fit snugly into holes in the side, top, and bottom pieces. When spread by driving in tapered wooden pins, they hold the box together.



snugly into holes in the side, top, and bottom pieces. When spread by driving in tapered wooden pins, they hold the box together.

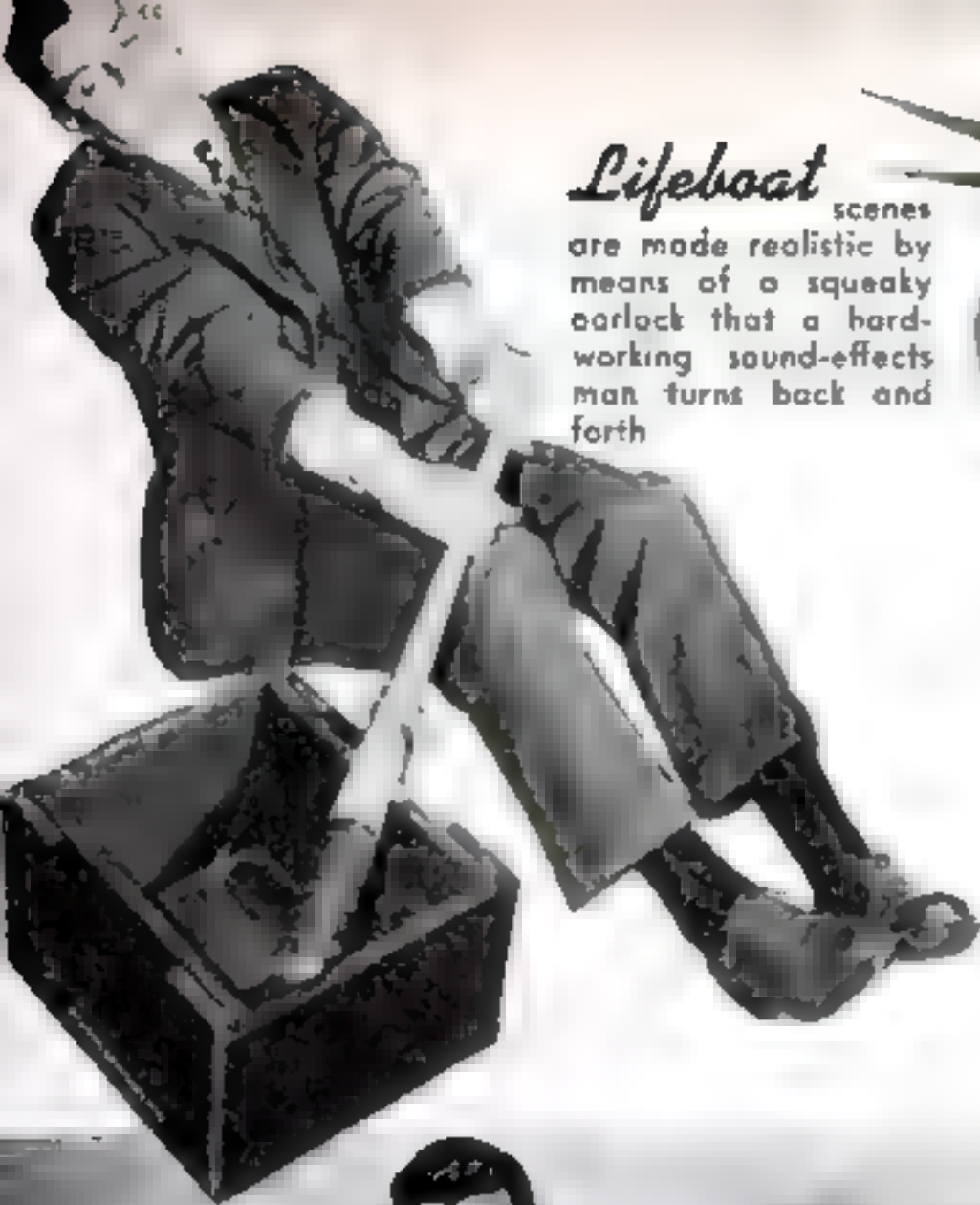


**VENTURI TUBES** made of plastic instead of die-cast metal are saving weight in our warplanes. They are molded of ethyl cellulose Lumarith by Cruver Manufacturing Co., Chicago. The large tube above replaces the smaller but heavier metal one shown beside it.



**BENT PROPELLERS** become straight in a "cold straightening fixture" now being used in air maintenance depots throughout the world to keep U. S. air fleets on the wing. Invented by Robert P. Elam, associate aircraft supervisor at the headquarters of the Air Service Command, Patterson Field, Ohio, the device consists of a heavy frame fitted with hydraulic jacks which apply steady pressure on the bent blades to restore their shape.

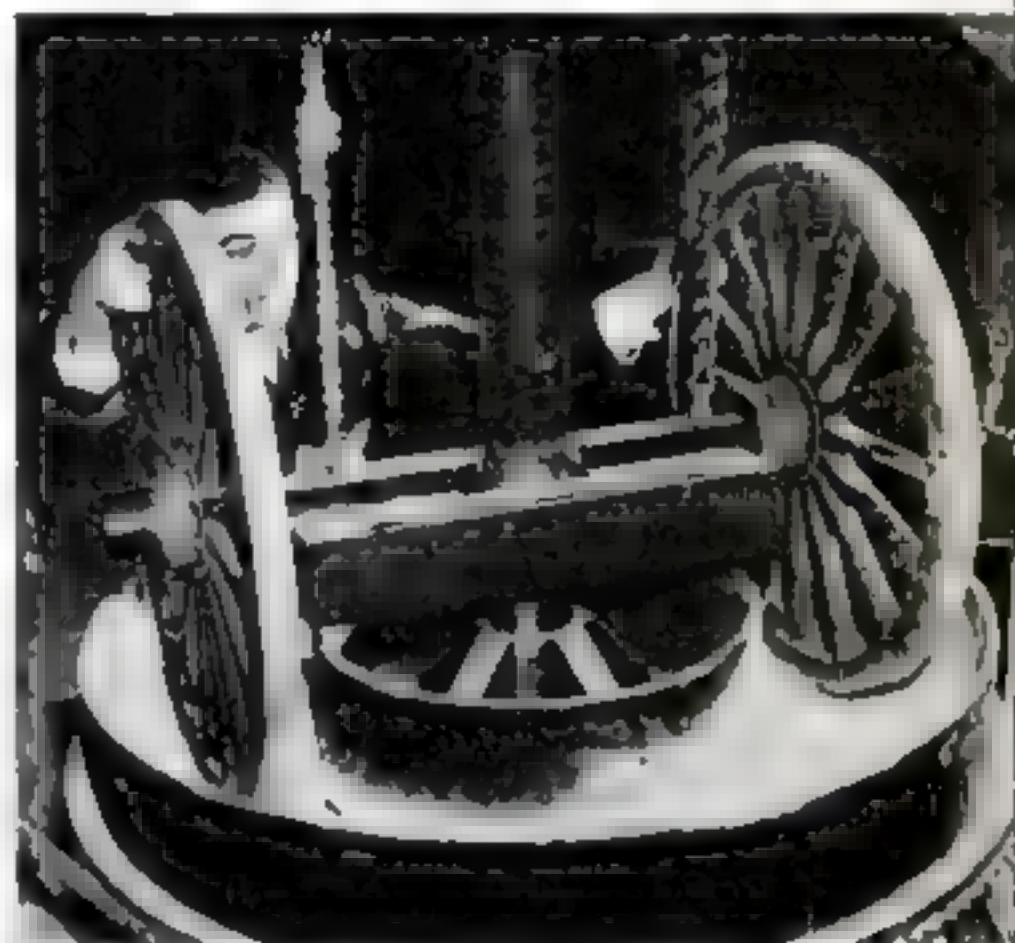




*Lifeboat* scenes are made realistic by means of a squeaky earlock that a hard-working sound-effects man turns back and forth

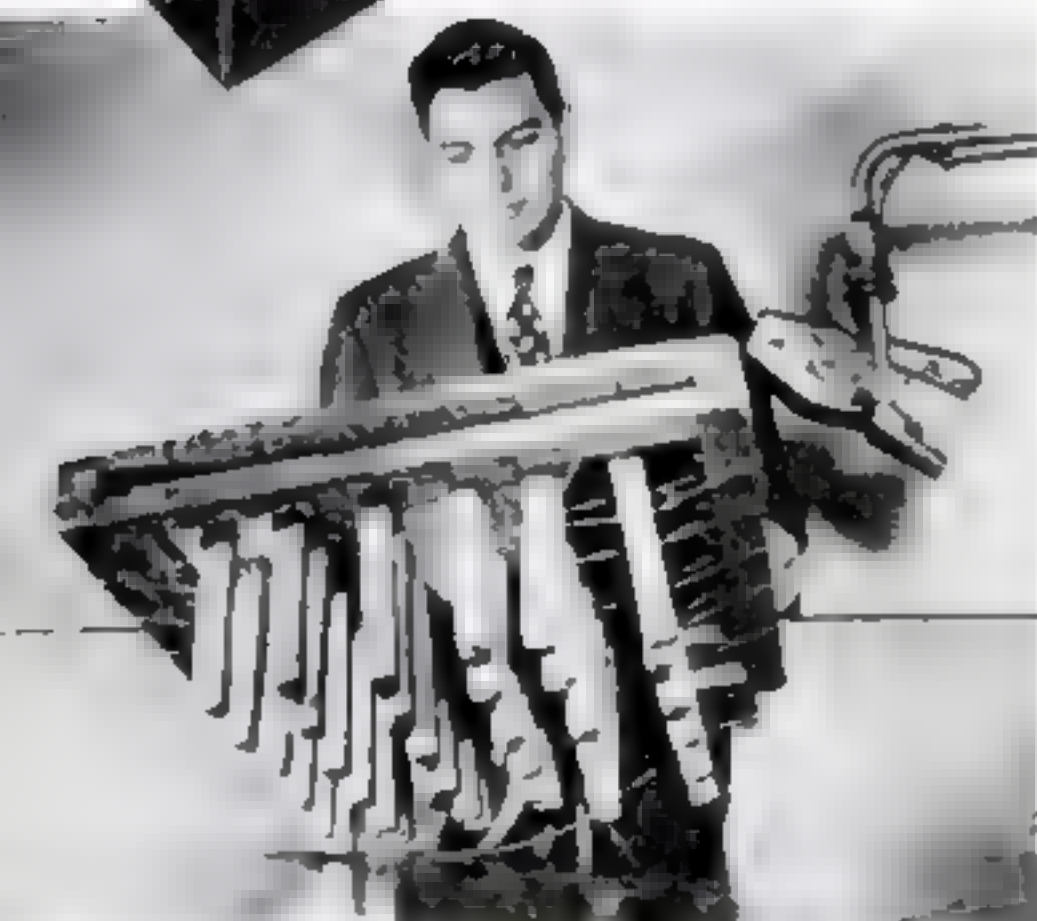
## WAR IN YOUR LOUDSPEAKER

Radio Sound-Effects Men Reproduce Din of Battle



*Artillery.* If they can't get the right effect any other way, sound men build at least part of the object whose sounds they want to imitate. The wheels above are used to portray the clank and rumble of moving artillery

*Cannon Fire* is made to boom out from your loudspeaker by pounding on a "drum" (below) whose head is an eight foot square piece of specially treated hide



*Marching* feet are a commonplace in wartime radio scripts. To produce the necessary sound effect, a studio technician skillfully manipulates the 36 wooden pegs of the device pictured above

*Gestapo.* To produce the clatter of men forcing their way into a room, this sound man kicks a door vigorously, then rends fruit boxes to portray the splintering of the door panels





**WEATHER PHENOMENA** ranging from Eastern sandstorms to Arctic sleet are manufactured by the AAF Materiel Command at Wright Field, Dayton, Ohio. A room specially designed for testing men and equipment under all climatic conditions is provided with blowers that generate wind; batteries of lamps that yield the equivalent of sunlight; a hopper that sends forth clouds of sand; shower heads that pour down rain; and nozzles that spurt water to make fog. Humidity and temperature are also controlled. A rubberized bathtub covering the floor makes it possible to flood the room, creating a small lagoon where soldiers paddle one-man life rafts (right) designed for flyers.



**OZONE**, an extremely active and germicidal form of oxygen, can now be generated with accurate control by ultraviolet rays from a new mercury-vapor lamp. Demonstrated above by Samuel G. Hibben, research expert of the Westinghouse Lamp Division, the new germ-killer employs a coiled quartz tube. An important application foreseen for it is in making storage eggs stay fresh longer by surrounding them with an atmosphere of ozone, which soaks into the "pores" of the shells. Ozone can also be used as a commercial bleach, to make quick tests of the color-fastness of inks and dyes. It is commonly produced by passing electric sparks through air.

**SMUGGLERS' TRICKS** are being tried by the Germans in their efforts to get contraband materials past the Allied blockade. The square tins shown below were shipped on a neutral vessel under navicert as bacterial peptone. When opened by suspicious British blockaders, they were found to contain gland extract for treating shock.







**MONAZITE SAND**, produced by the disintegration of granite rocks, gives us rare-earth metals and thorium. Close-up below shows how the brittle resinous grains vary from honey-yellow to brown. In peacetime, much of it went into mildew-proofing fabrics (middle photo, below) and making "flints" for cigarette lighters. War uses are in electrodes for searchlights, filaments for radios

# War Metals from Sand

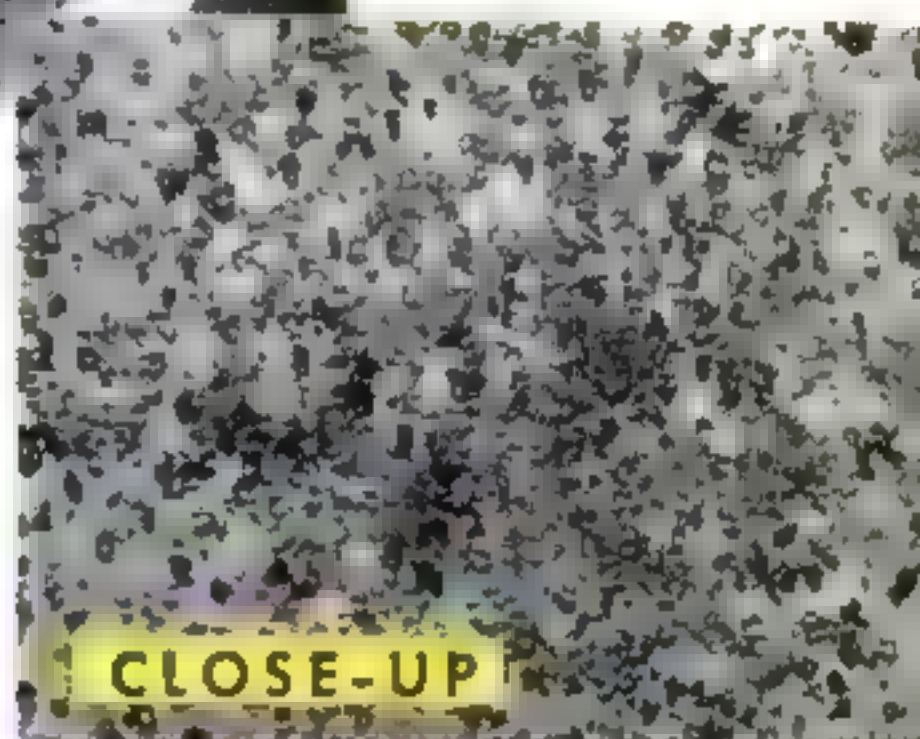
**W**ELDING goggles, searchlights, incandescent lamps, radio tubes—these are only a few of the wartime necessities that are improved by the use of little-known elements found in monazite sand. Produced in dune and beach deposits by the weathering of granite rocks, this sand was once used chiefly in making Weisbach mantles for gas lighting; now it is vital as the only commercial source of the "rare-earth" metals and of the metal thorium.

Cerium, most abundant of the rare-earth metals, is mixed with carbon to make cores of arc-light electrodes for searchlights, film projectors, and therapeutic lamps. In England, it is alloyed with aluminum to produce a strong, lightweight metal for airplane castings. Cerium acetate makes textiles mildewproof. Other salts have medicinal uses. Salts of lanthanum and erbium, members of the rare-earth group, go into beauty preparations.

Welding-goggle lenses made with praseodymium and neodymium cut off useless visible rays and harmful ultraviolet rays to protect workers' eyes.

Thorium, also obtained from monazite sand, finds important use in radio tubes. Filaments containing a trace of this metal operate at lower temperatures than filaments of pure tungsten, prolonging the life of the tube. Both thorium and cerium salts are used as catalysts in chemistry.

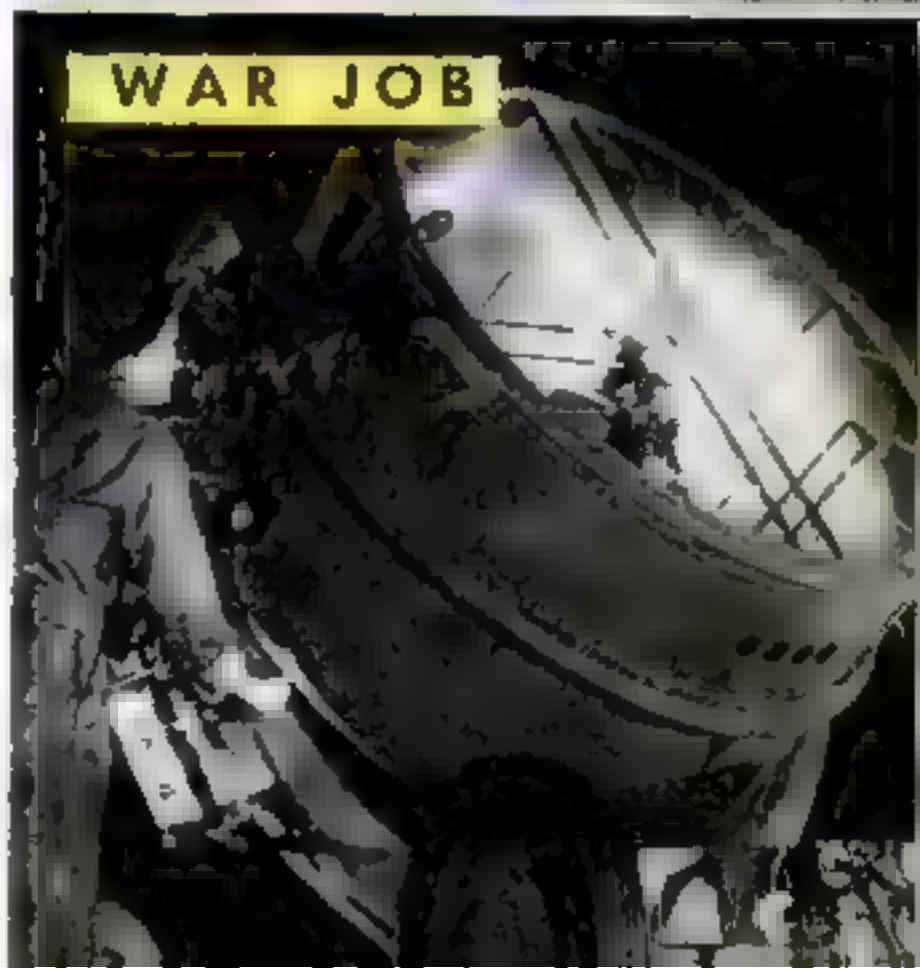
Before the war, 75 percent of our supply of monazite sand came from India. With that source cut off, most of our importation is now from Brazil. If necessary, however, we can get all we need by working deposits in the Carolinas, Florida, and Idaho.



**CLOSE-UP**



**PEACE JOB**



**WAR JOB**





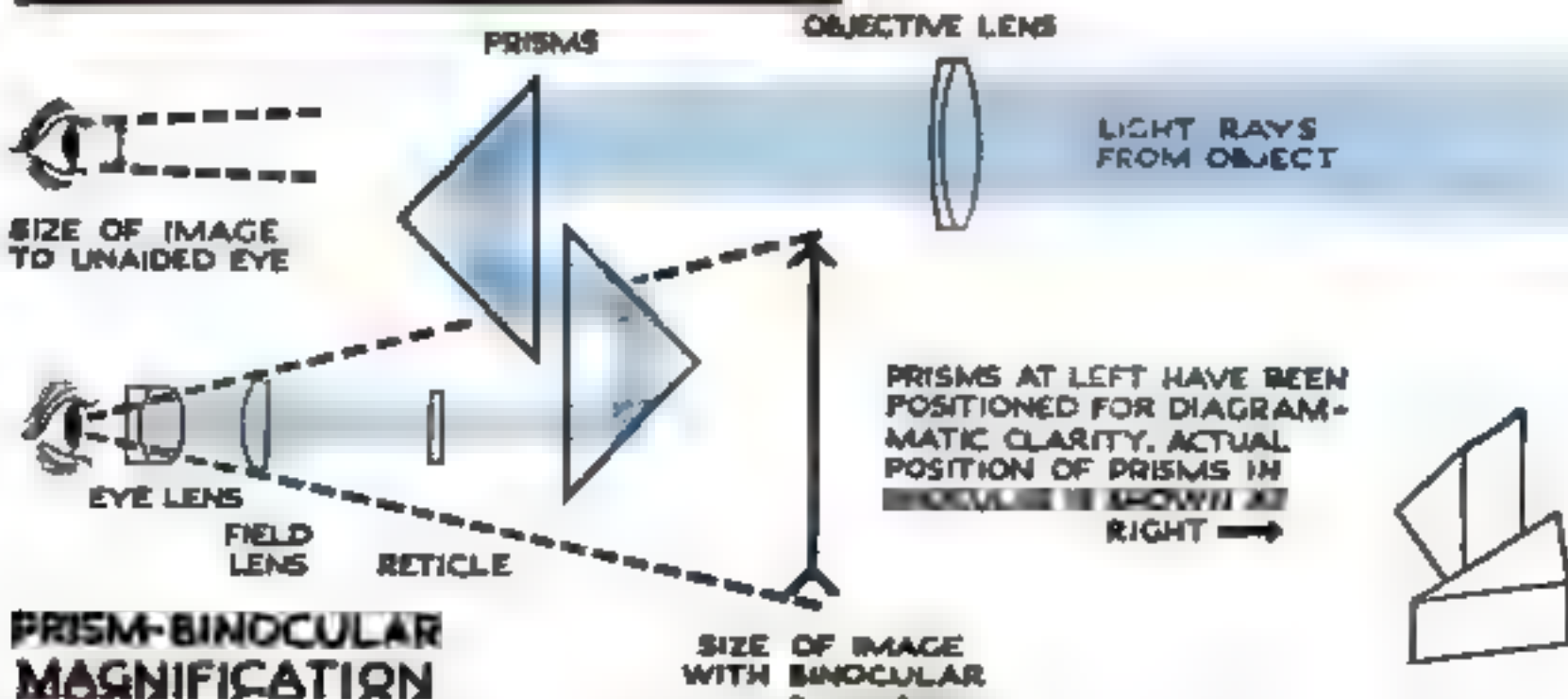
Photographs taken by **ROBERT F. SMITH**  
of Universal Camera Corp., New York, N. Y.

**A**MERICA'S front-line fighters must see more than meets the eye. In every battle zone—land, sea, and air—they're called upon to perform ocular miracles. It's their job to unmask camouflage, dissect heat and haze, and scan hopeless dis-

tances to get information that spells victory. They must spot the enemy before he sees them. And they're doing it with American-made prism binoculars, now in mass production for the first time.

The ingenuity that made this possible has been rewarded with an "E" presented by the Army and Navy to the Universal Camera Corporation of New York. On the verge of ruin in 1940, when war blacked out its European film markets, this firm rallied to take a top place among war industries. Before the end of 1943, its production hit 11,000 binoculars a month for our armed services. That means turning out 150,000 optics (lenses and prisms), to say nothing of fabricating and assembling more than a million metal parts.

Universal has tossed out all the old, traditional methods of making binoculars. Other-

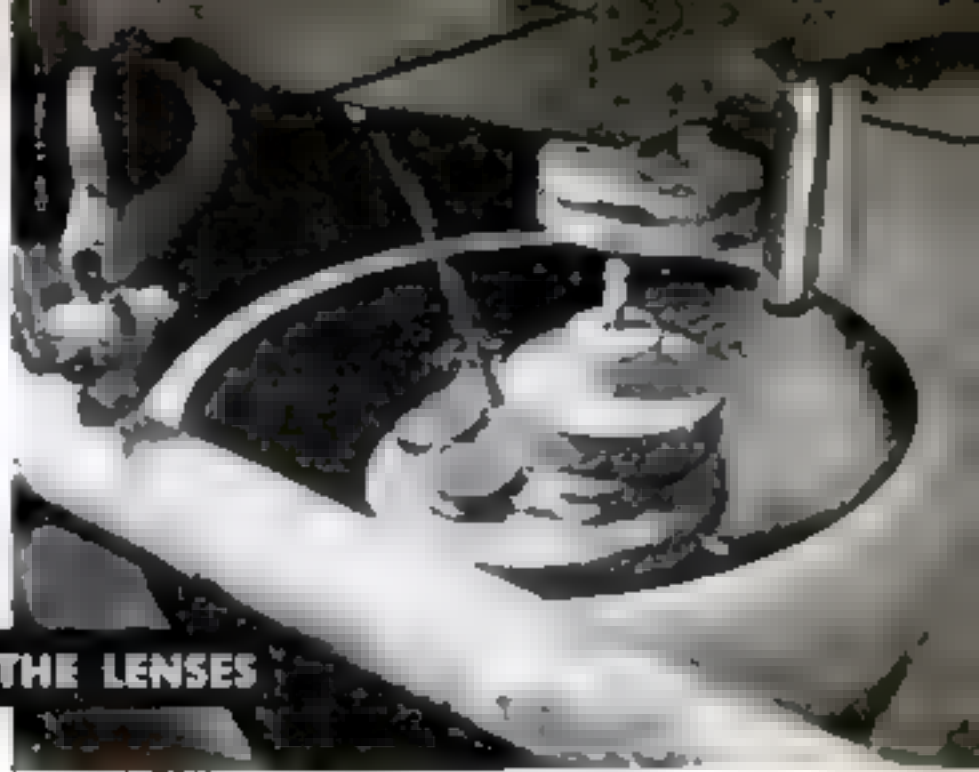




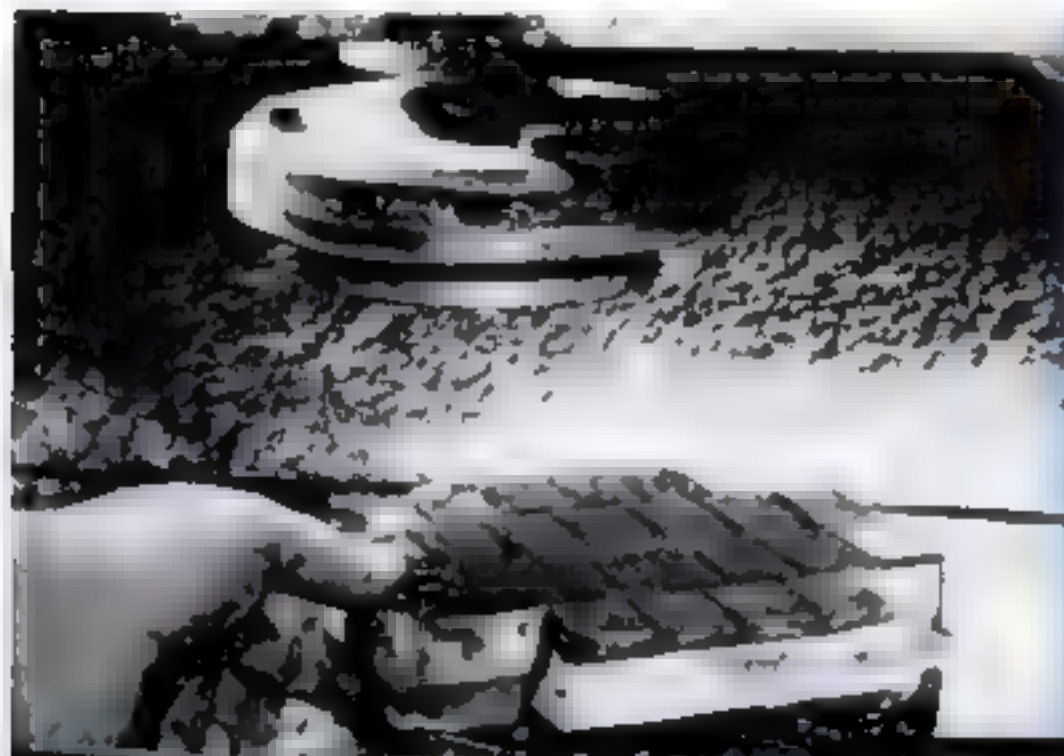


## GRINDING THE LENSES

Grinding the objective lenses of prism binoculars is done mechanically with wax surfaced wheels while a solution of red oxide of iron flows over the work (above right). Batteries of these machines, whose grinding wheels are automatically controlled as to



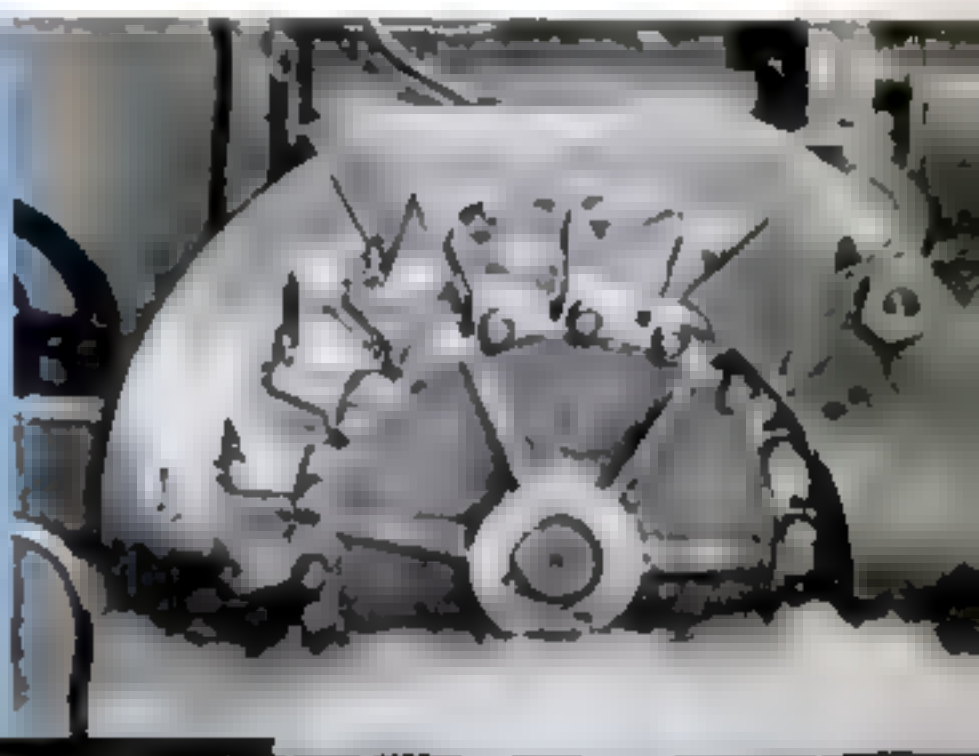
speed and pressure, now mass-produce lenses formerly turned out laboriously by skilled craftsmen. So precise are the machines that they can smooth down a lens to a tolerance of 1/100,000 of an inch. During milling and polishing lenses get 116 inspections



## MAKING THE PRISMS

Here a group of prism blanks made of light barium crown glass, are being placed in a diamond cutting machine. Precisely machined metal blocks are used as holders for the prisms, which are set into recesses and held fast with wax and binding strips

With the faces and sides of the prism now carefully polished, the next step is to bevel all its edges. This is a hand operation in which the prism is held against a grinding wheel, while a stream of ordinary water is played over the stone as a grinding fluid



After being rough-cut, the prism blanks are set in the niches of a milling machine that revolves in a bath of grinding fluid. As the machine turns, it brings one side of each prism into contact with a polishing disk, which is beneath fluid's surface

A clamp that will hold it firmly in the binocular is about to be placed on a prism. At this point the prisms have been paired off so that one having a plus deviation in the verticality of transmitted light is coupled with one of equal minus deviation







The housing for a binocular is cast from scrap aluminum, machined, then covered with strips of Vinylite, which has the texture of leather. A soldering iron fuses strips into one piece



A set of prisms is here being placed in one barrel of the binocular. Note that the other barrel is covered to prevent accumulation of dust, which must be guarded against at every stage of assembly

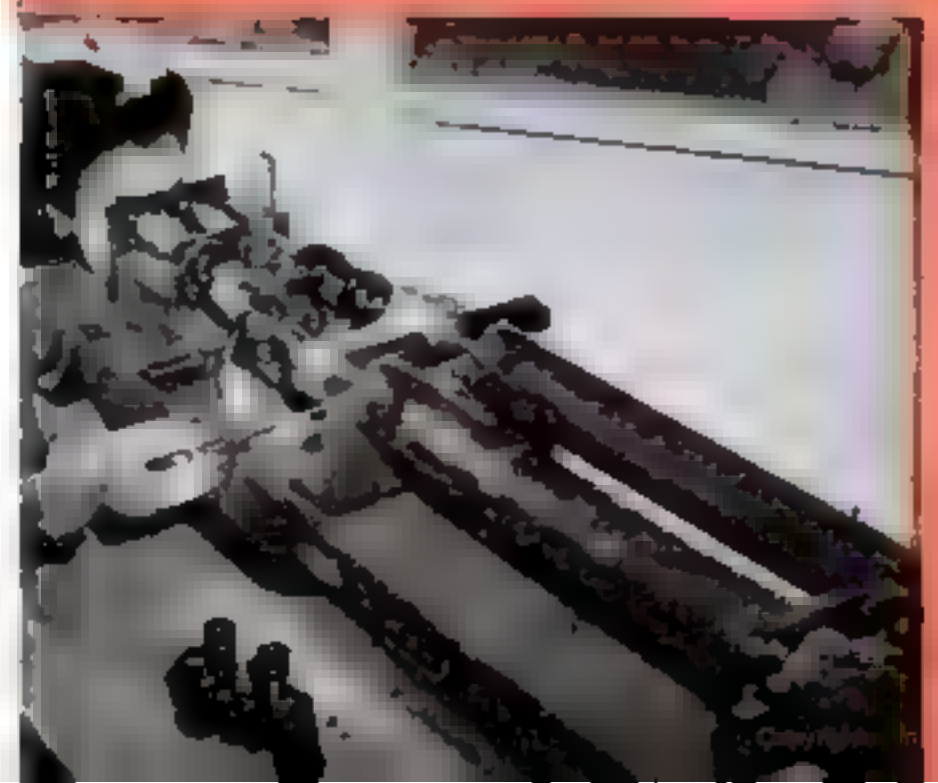
wise, it still might be slogging along neck-deep in red ink. It has turned a highly specialized art into a task for machines tended by unskilled labor. It has speeded the whole cycle of production to a degree undreamed of heretofore.

In preparing flawless faces of lenses or prisms, the basic steps are roughing, grinding, and polishing. The custom is to rough out each glass blank separately, then mount

them in a mold. After that, for the grinding and polishing operations, the mold is spun against abrasives. When one side is ground, it is turned over and ground on the other side. This procedure goes on through all stages of grinding and polishing. It's tedious and time-consuming.

At Universal's plant, sparks fly by application of a three-in-one process. Blanks are mounted on a mold that carries them

To reduce loss of light caused by surface reflection, optical elements in binoculars are being coated experimentally with magnesium-fluoride vapor. Tests indicate coated pieces transmit about 99 percent of light







Objective lenses, consisting of two lenses cemented together and fitted into metal rings, are immediately screwed into place after a suction tube (bottom) removes dust



Assembly of the binocular is completed with the mounting of the eyepiece. This part comprises the field, or collective, lens, a short barrel, and two lenses cemented together to form the eye lens

through roughing, grinding, and polishing as one continuous operation for each side. What's more, molds are so designed that unskilled hands can easily insert blanks. This simplifies the formerly complicated task of mounting. For the final polishing—a job that once required fine judgment and skilled hands—Universal automatically applies a liquefied oxide that not only does just as well, but also minimizes chances of

human error. In all, this new method of making binoculars has established a manufacturing precedent that will endure long after the war is over.

For the present, however, its task is to speed the flow of urgently needed binoculars to our fighters on land and sea. With the aid of these precision-built instruments, Americans in all services will be able to see better and fight better.



## INSPECTION

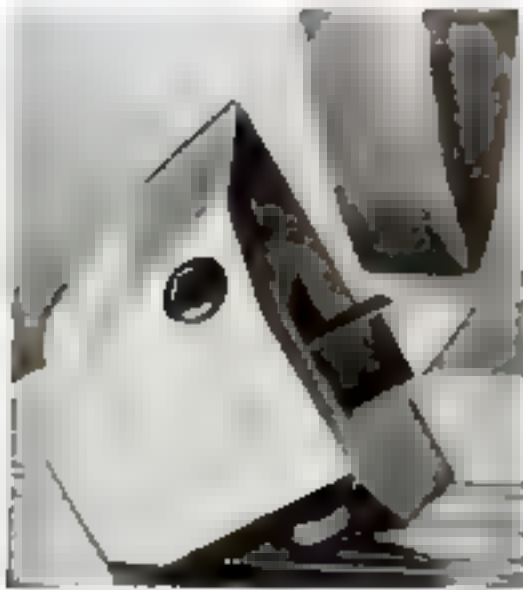
screen containing squares on which fine lines are drawn is used to test the ability of the binocular shown above to distinguish two parallel lines when they subtend five seconds of arc at the instrument. At the left, a military binocular is checked to see if its two ocular axes are parallel. The girl above is using an auxiliary scope, an ordinary telescope placed over one of the eyepieces of a binocular to magnify its normal resolution. A binocular is also sighted on an actual object to test clearness, color dispersion, and astigmatism. And, finally, it is placed in a tank of water to see how waterproof it is, and then dropped six feet into a sand pit to test its ability to withstand rough handling





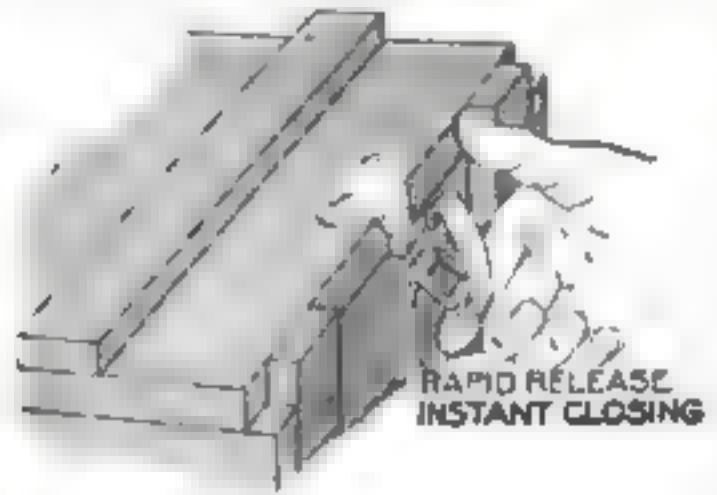
## new Tools

**DRILL TOOLS** can be changed in three seconds in this chuck while the motor is running, by sliding back a sleeve to release the tool and adapter (see below), then moving the sleeve forward to lock the new tool centrifugally. Made by R. M. Wright Co., Royal Oak, Mich.

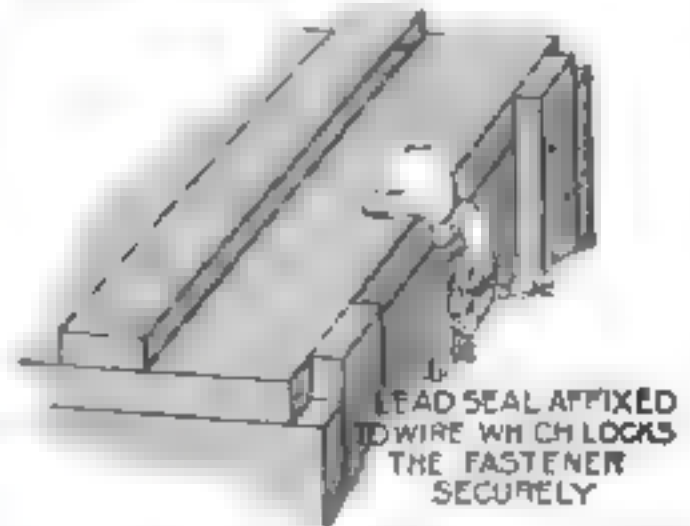


**GRINDING** both 60-degree and 29-degree threading-tool bits can be done accurately and quickly with the aid of a many-sided fixture brought out by Robert H. Clark Co., of Los Angeles. The bit is held by a setscrew in the fixture, which is properly positioned for the thread angle

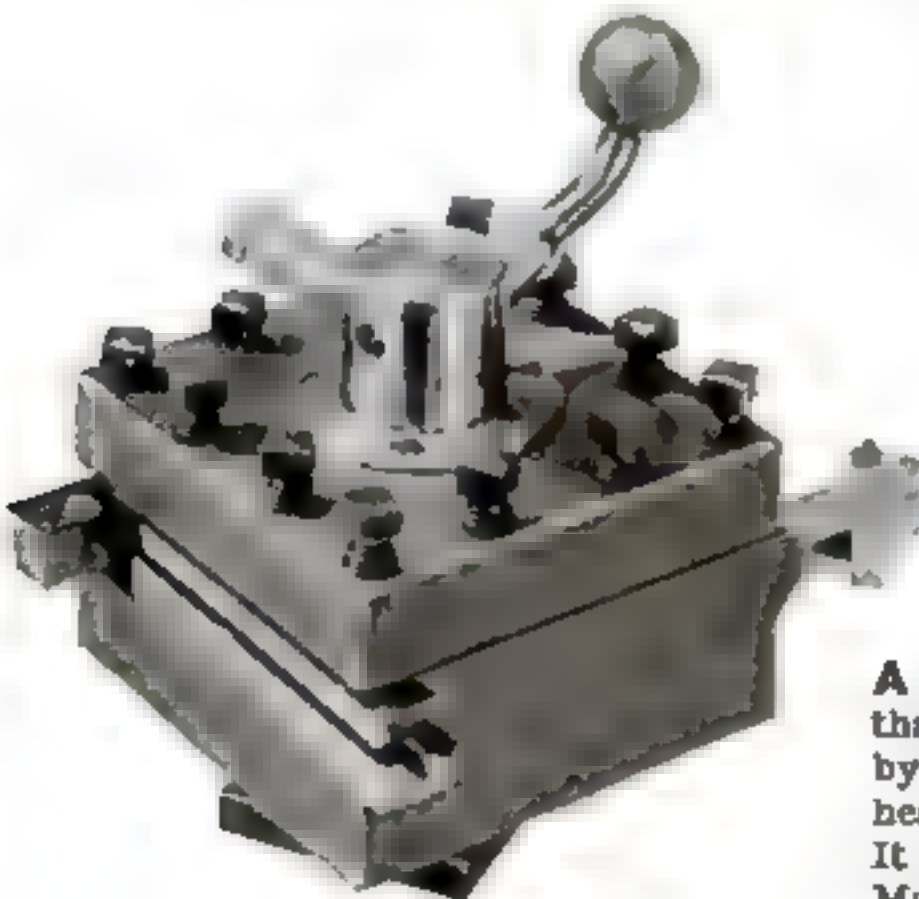
desired, as indicated on the fixture. The design of the fixture permits it to be clamped to a table or held by a magnetic chuck, as shown.



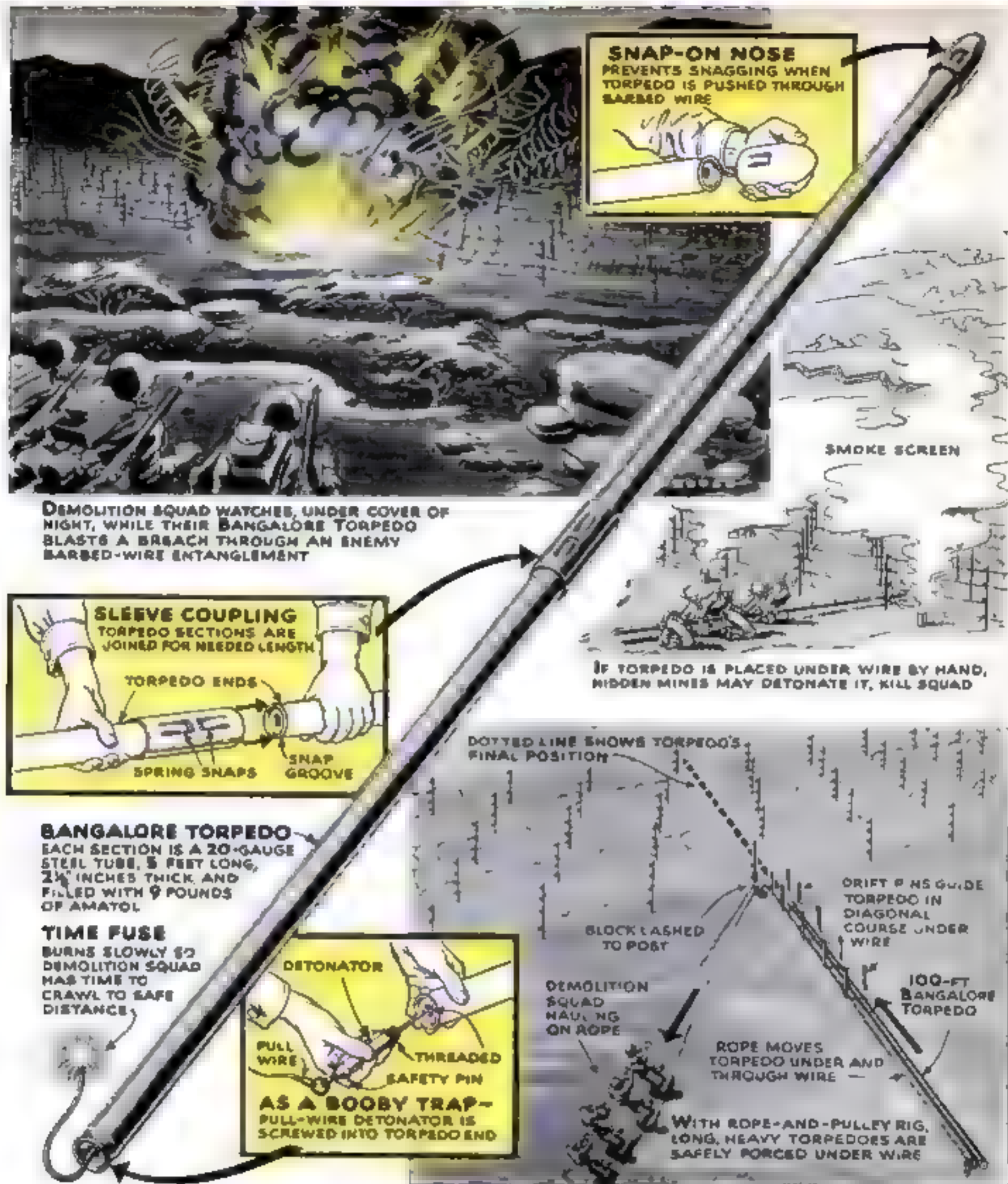
**TOGGLE-TYPE LOCKS** that save metal and need only four screws each for installation have been developed by the Maximlok Co., of New York, for use on Army ammunition boxes.



**A TOOL-POST TURRET** carrying four cutters that can be presented to the work in turn by turning a handle has been designed for both heavy roughing cuts and precision lathe work. It has automatic indexing, and is made by the Mark Naught Co., Portland, Ore.





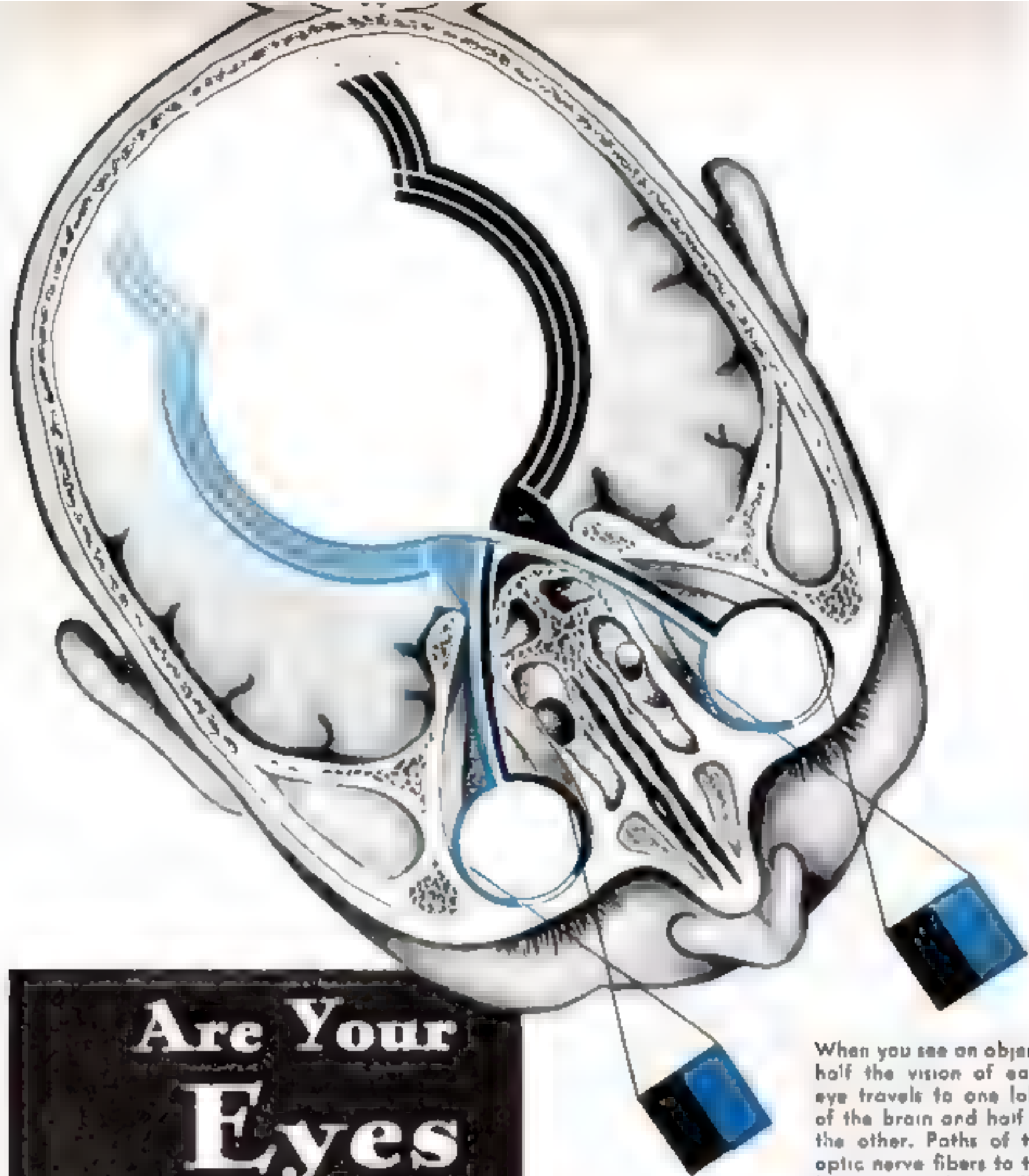


## Pulleys Place Giant Bangalorees

**J**OINTS of explosive-filled metal tubing, sleeve-coupled to lengths of 100 feet or more, alither under the enemy's barbed-wire entanglements to blast a breach for our assault troops. Fragments of metal cut the wire like knives and sweep a path 20 feet wide. Far more effective than the original bangalore torpedo (P.S.M., June '42, p. 49), the current version is placed by an ingenious snatch-block arrangement. A scout creeps to the obstacle, attaches the

block to a post or picket, and runs a rope through it. One end is secured to the butt of the torpedo, the other in the hands of the demolition squad stationed at a safe distance. Guided by drift pins, the torpedo slides under the wire. Its round-capped nose prevents snagging. Short lengths make deadly booby traps when the time fuse is replaced by a nonelectric detonator and trip wire. It's also effective in exploding treacherous land mines that might impede advance.





When you see an object, half the vision of each eye travels to one lobe of the brain and half to the other. Paths of the optic nerve fibers to the brain are shown diagrammatically above

# Are Your Eyes Right?

TODAY, MORE THAN  
EVER BEFORE, YOU  
SHOULD GUARD YOUR  
PRICELESS VISION

Drawings by JOHN GILMORE

**M**OST of us, unfortunately, take our eyesight for granted. Yet in wartime poor vision is more than ever a calamity. It not only can dull our minds, contort our faces, shatter our nerves, and even lead to total blindness; it also cheats our country of our best services. From the standpoint of patriotism alone, we should know our eyes better

The extent of our laxity is shocking. A recent survey conducted by the Better Vision Institute revealed that no less than 7,000,000 Americans in war plants are guilty of neglecting faulty eyesight. It found that, despite the almost universal exclamation, "Oh, my eyes are O.K.," seven out of every 10 war workers have defective vision and only three have done anything about it.



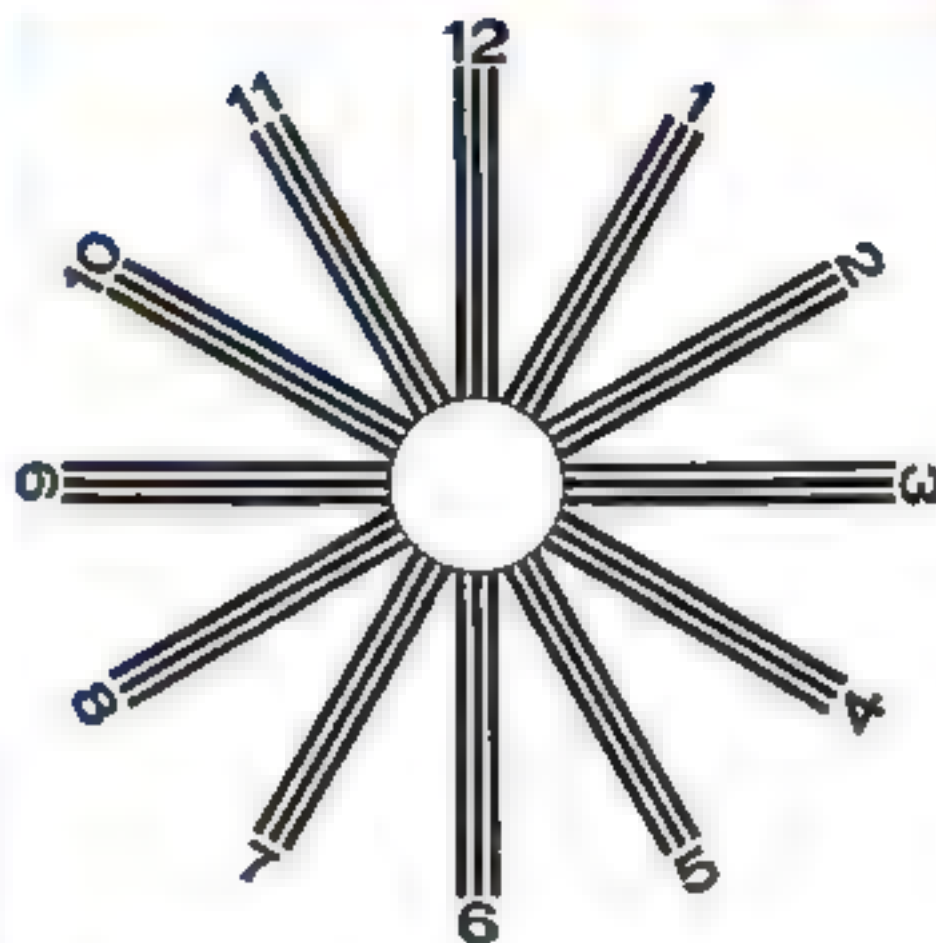
## Easy Test for Astigmatism

These workers, with their weak, blurring, flickering eyes, are wasting time, ruining precious materials, and causing accidents. They are, as the Institute puts it, "housing a saboteur."

So important is good eyesight in the Army that mobile optical units are assigned to all field forces. Soldiers with defective vision are examined at regular intervals and given corrections. But only 15 percent of the war plants investigated by eye specialists provided periodic eye examinations; only two out of 10 plants recorded eye conditions of workers involved in accidents, and three fourths of the plants had no means of selecting visual qualities necessary for special, intricate jobs. These employers are as guilty as the workers in neglecting the eyes. They, too, house potential saboteurs.

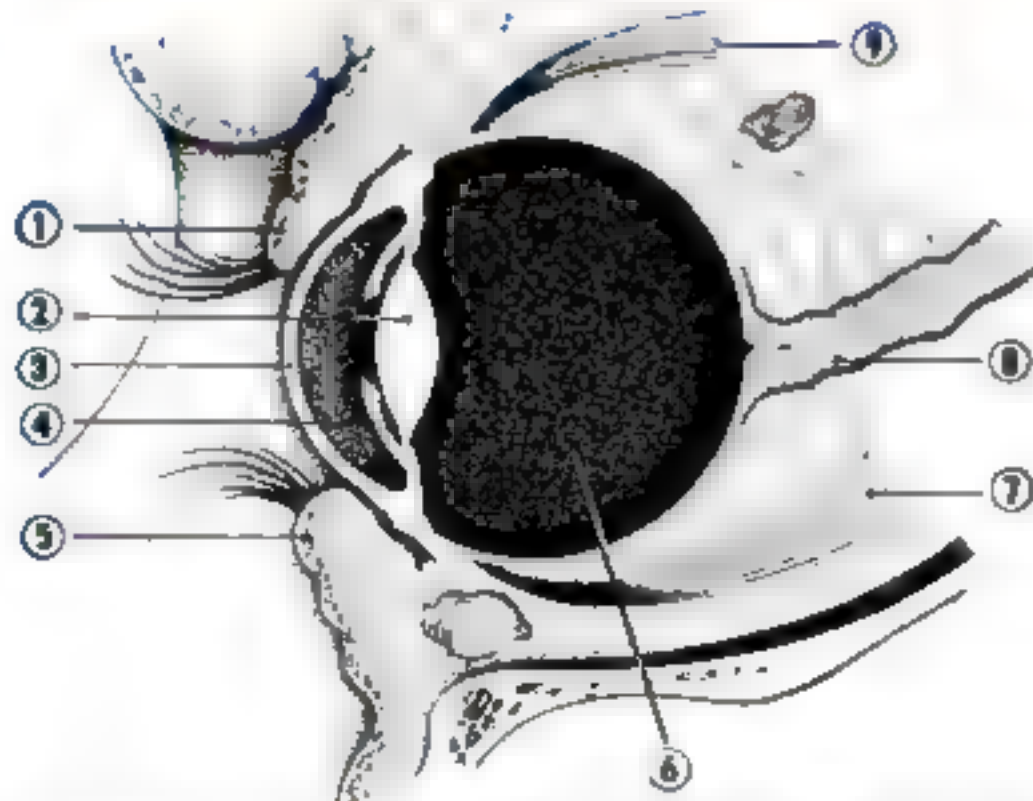
There's no excuse for this dangerous civilian laxity. Eye specialists, in sufficient numbers, are available. They have the proper equipment and knowledge. And the benefits of eye care far exceed the efforts involved; for good vision, with or without the aid of glasses, is one of our greatest physical wonders.

Science has yet to perfect an instrument as ideally suited to conditions imposed upon it as our optical system. The nearest approach is the camera. When the camera



Astigmatism is the inability of the eye to see horizontal and vertical lines with equal clearness. Study the diagram above and note if some of the lines appear to be thicker than others. Now rotate the diagram slowly. Does this tend to make other lines appear to be thicker? If it does, then you have an astigmatism

catches a picture by means of a lens, it projects it to the back of a black-walled box, where it impinges on a sensitized plate that reacts to light, thus fixing the image. To obtain clearly focused and well-illuminated pictures at all times despite changing outside conditions, the lens is equipped with a diaphragm that contracts the lens



### A CROSS SECTION OF THE EYE

1. Upper lid
2. Lens
3. Cornea
4. Iris
5. Lower lid
6. Vitreous body of the eye
7. Inferior rectus muscle
8. Optic nerve
9. Superior rectus muscle



aperture as required. The eye, too, possesses a diaphragm which regulates its own lens aperture. Back of the lens is a light-sensitive curtain on which images form. These images are flashed by a unique wiring system of optic nerves to brain centers responsible for vision.

Each eye turns freely in its skull socket, protected by the bony structure and guided by six little muscles working in pairs. For perfect vision, the pairs of muscles must be of equal length and strength, so that in normal position the eyes look straight ahead. The eyeball, which is the eye in its totality, is round except for the window, or cornea, at the front. Through the cornea, light rays reflected from objects enter the crystalline lens within the eye and pass to the rear curtain or retina.

By means of an ingenious system of valves, the eyeball is kept "blown up" with ocular fluid. If it is pierced, this transparent colloid flows out and the eye collapses like a punctured tire. But the eye may not be lost; should the opening close, the fluid collects once more and the eyeball again fills.

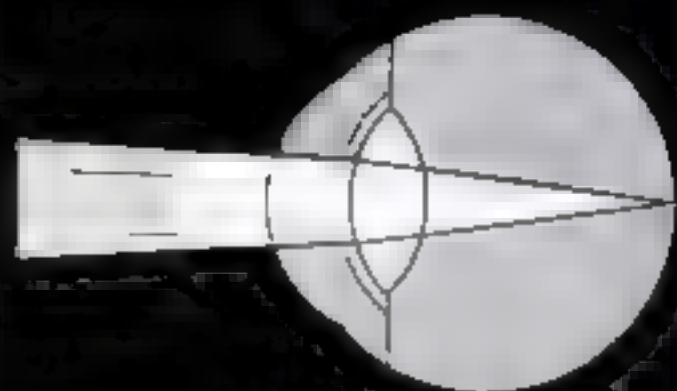
Those fortunate persons whose vision is normal have lenses within the eyes of exact power to focus light rays perfectly at 20 feet. Rays vary from nearly parallel ones that come from a distance to those from near-by objects, which spread as they reach the eye. So, like the camera diaphragm, muscles surrounding the lens must change its surface to project the correct image. This is called accommodation. It is the "open sesame" of good eyesight.

Many defects in eyesight stem from the fact that our eyes must work as a pair. No greater teamwork is required than that of our eyes. They must be in perfect alignment, move in unison, have the same power of accommodation, and the same reactions to light. One of the most prevalent faults in vision results from imperfections in eye muscles. Our eyes turn inward, outward, upward, or one above the other—and efforts to align them cause nervousness and fatigue. But this defect, and at least four other common deficiencies, generally can be corrected by exercises or use of eyeglasses.

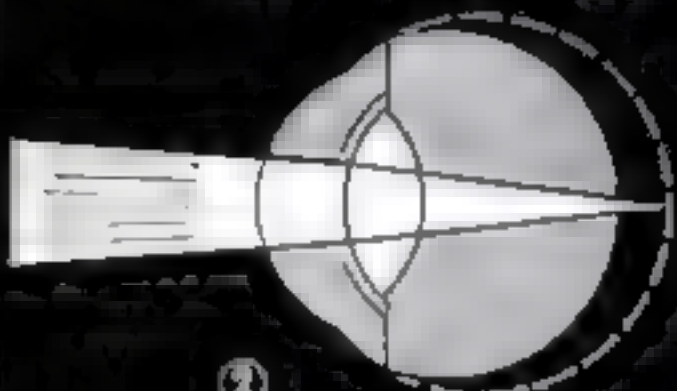
Failure to heed the first indication of failing vision is both foolish and unpatriotic. No good can come of it. It is our duty not only to keep our eyes open, but to make sure they see well.

In normal vision (1), light rays entering the eye come to a focal point right at the retina. If the eyeball is too short (2), the rays focus at a point in back of the retina, causing farsightedness. This defect is corrected with convex lenses (3). If the eyeball, however, is too long (4), the focal point is in front of the retina, and the result is nearsightedness. Concave lenses (5) are then required

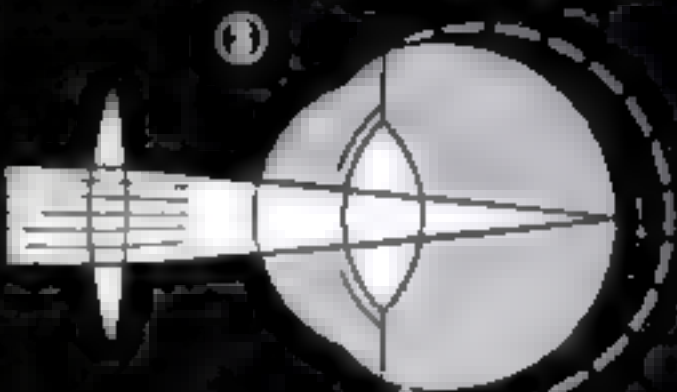
## HOW GLASSES HELP YOU TO FOCUS CORRECTLY



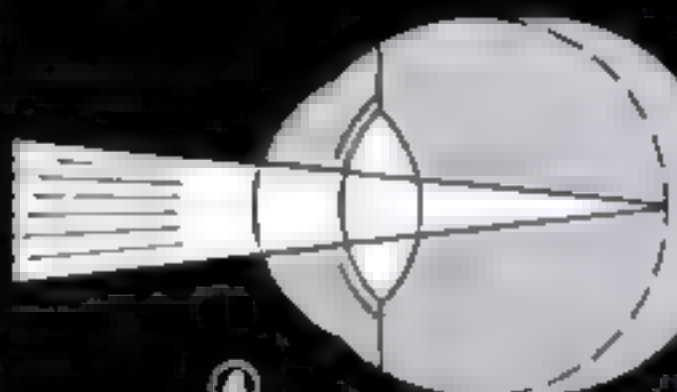
① NORMAL EYEBALL



② EYEBALL TOO SHORT



③

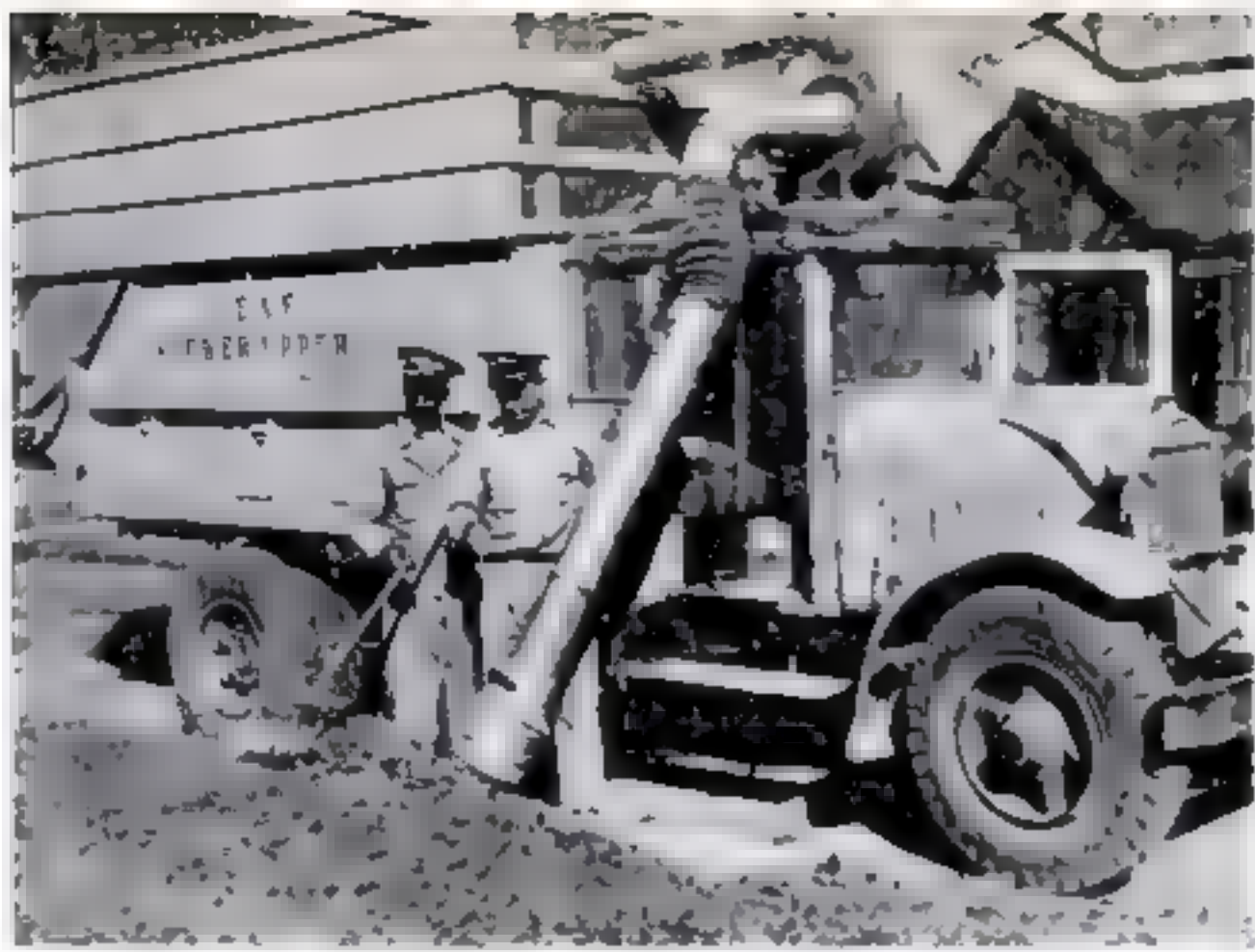


④ EYEBALL TOO LONG



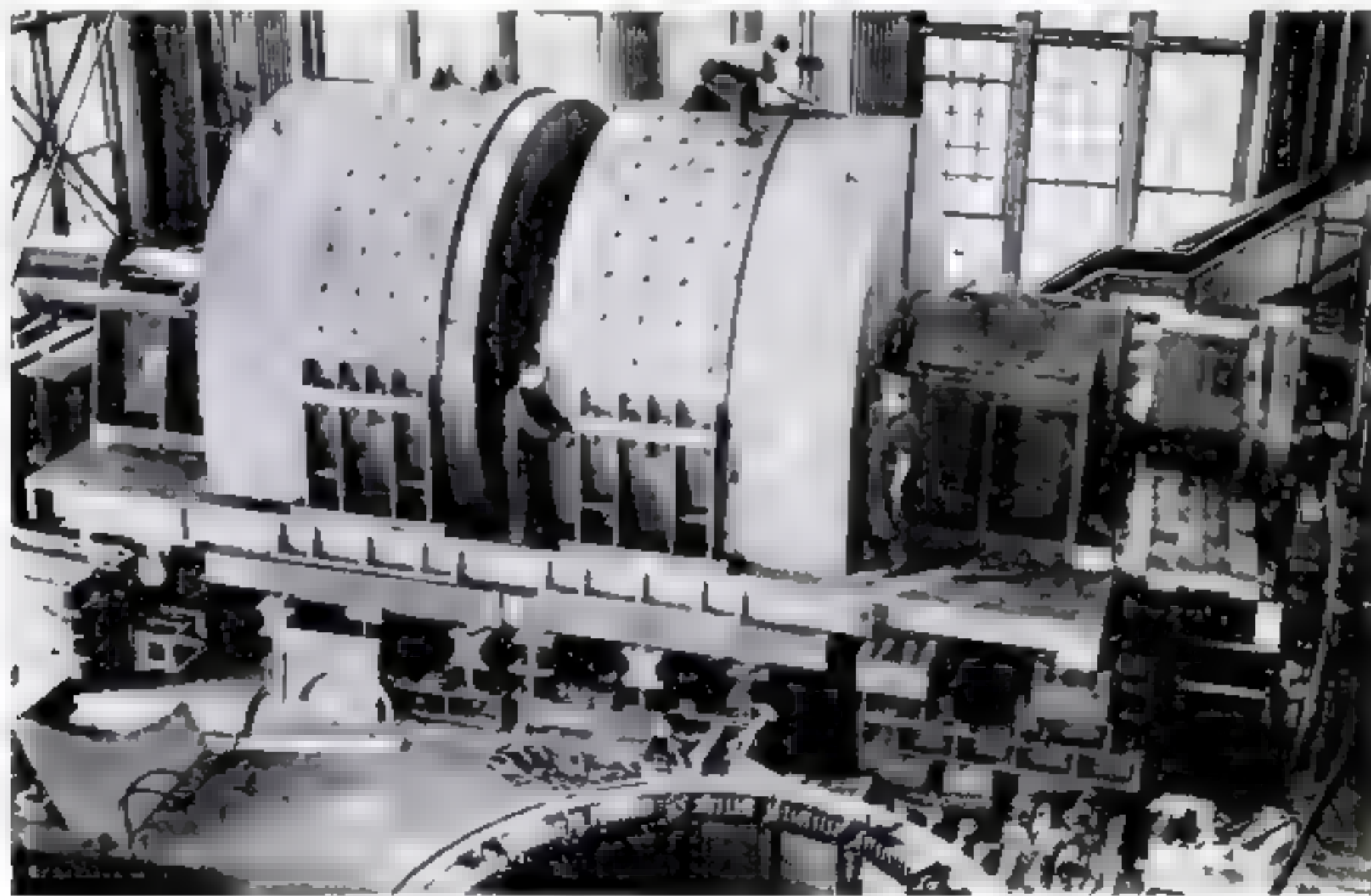
⑤





**DEAD LEAVES**, an autumnal problem in most towns, are disposed of easily in Columbus, Ga., by the "Leaf Sucker-upper," a machine that draws them up through a vacuum hose. This device—thought to be unique—is carried by a truck, and suction is created by a three-horsepower gasoline engine. Once inside the body of the truck, the leaves are crushed for immediate use as mulch in parks and gardens.

**A MILLION POUNDS** is the approximate weight of the world's most powerful electric motor, built at the General Electric plant in Schenectady, N. Y. The machine is shown in two views, as workers prepare it for installation in the largest steel plant west of the Mississippi, at Geneva, Utah. Here the electric colossus will drive a reversing rougher in a mill producing steel plates for shipyards and war plants on the West Coast. Rated at 7,000 horsepower, with a shaft speed of 25 revolutions a minute, it could hoist a destroyer to the height of a 15-story building in a minute.



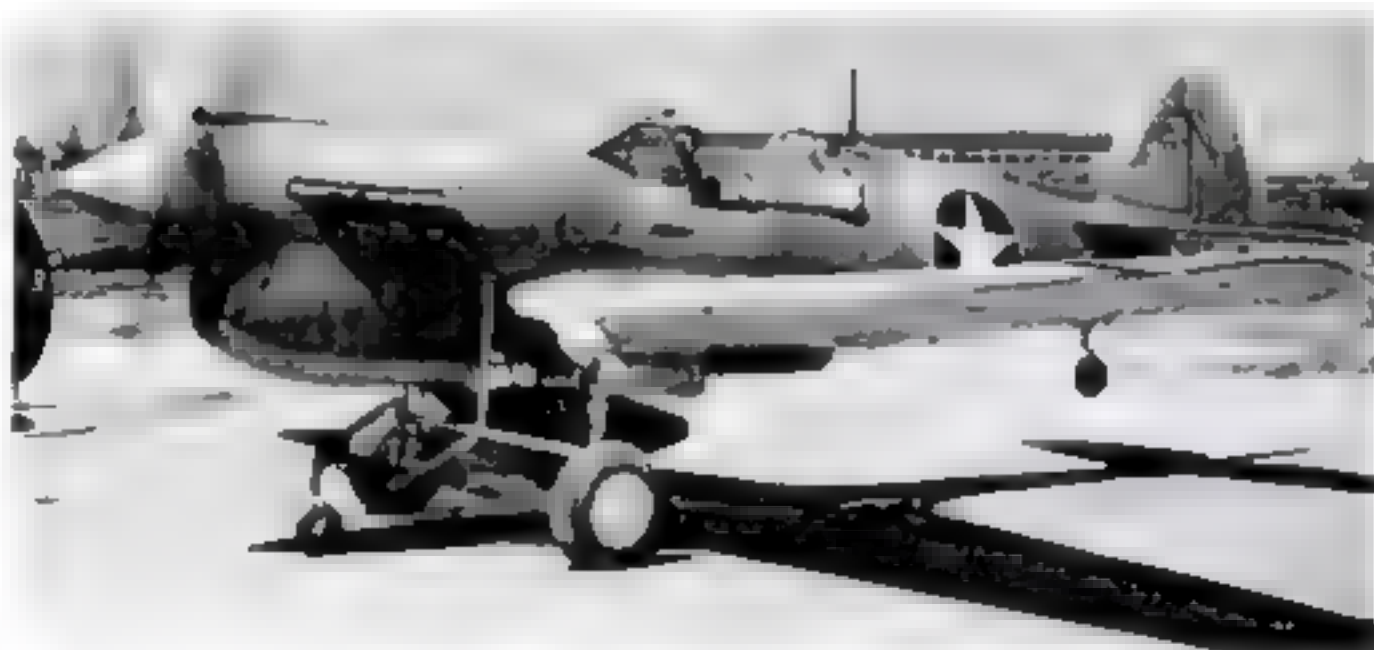




**TWO-MAN CLASS-ROOM.** To facilitate transition from advanced training to the complex job of flying a Bell Airacobra, this TP-39 was constructed. The student sits in a normal cockpit, the instructor in front. An added dorsal fin maintains stability, and dual controls provide safety. Any standard P-39 can be converted,

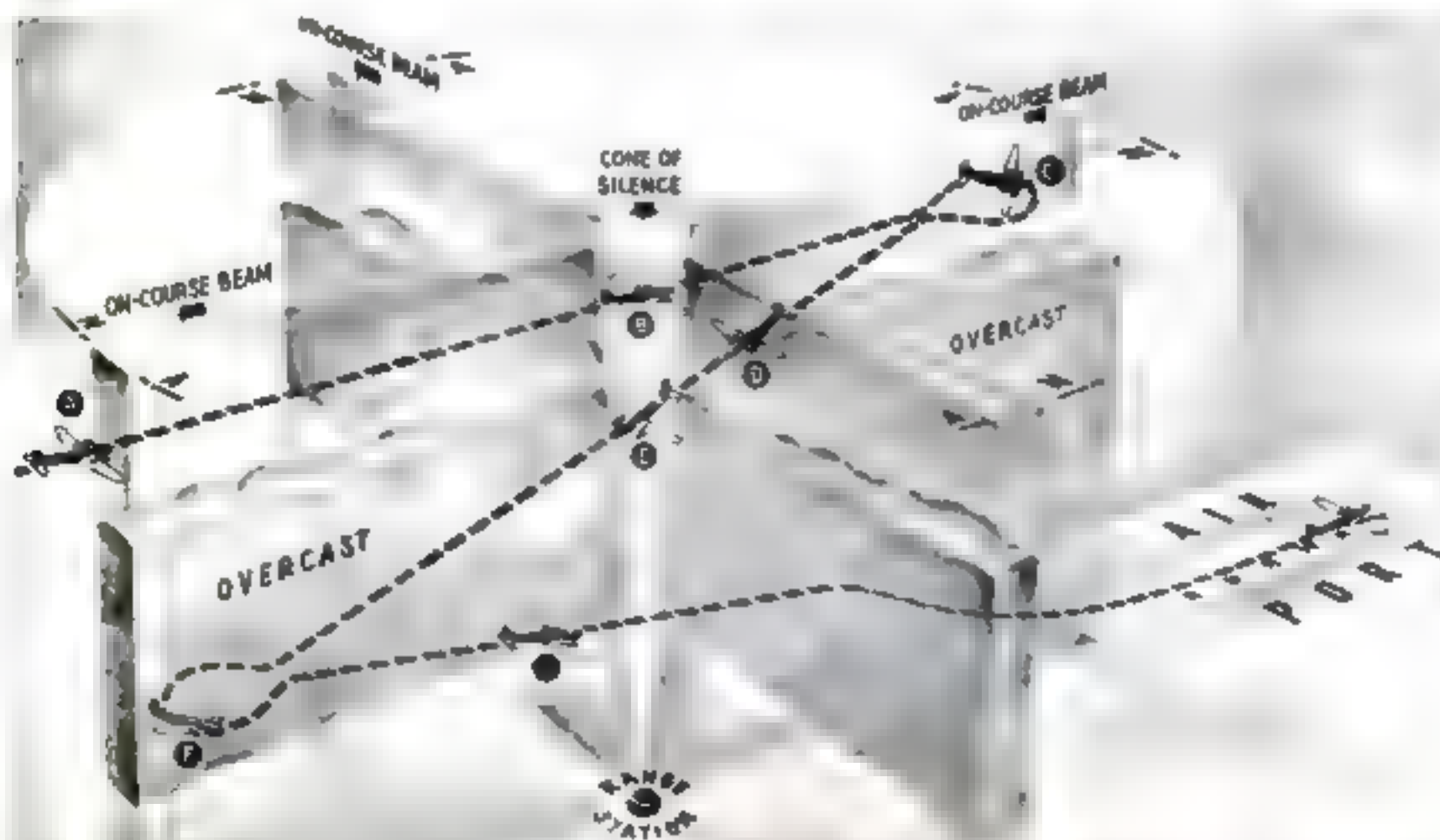
## CAN'T BE FLOWN.

This nonflying P-40 was developed by Curtiss-Wright to solve the problem of teaching Army mechanics to taxi high-speed fighters. It has two seats, nontipping landing gear, and interphone for easy instruction. Dual controls correct mistakes made by novice ground pilots.



**OVERCOMING THE OVERCAST.** This Western Airlines drawing clearly shows instrument-landing procedure through an overcast. On-course beam is a steady tone made by the dash of the dash-dot radio code letter "N" overlapping the dot of the dot-dash code letter "A." The pilot follows this tone through the location-giving "cone of silence" *B*, turning back at *C* and letting

down into clouds at *D*. At *E*, he again gets location and continues, to turn at the point *F*, predetermined by the speed of glide, and comes back along the same on-course tone to break through clouds at *G* at about 800 feet and approximately two miles from the field, right in line with the runway. Straying from the on-course beam is indicated by reception of "A" or "N" signal.

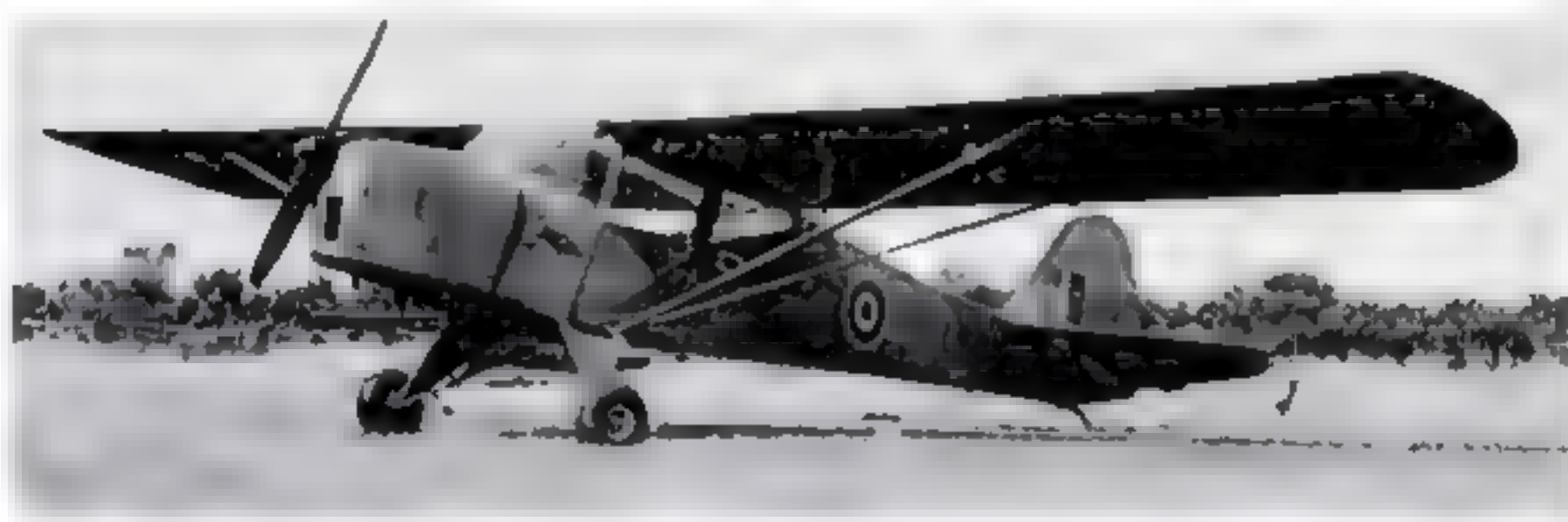






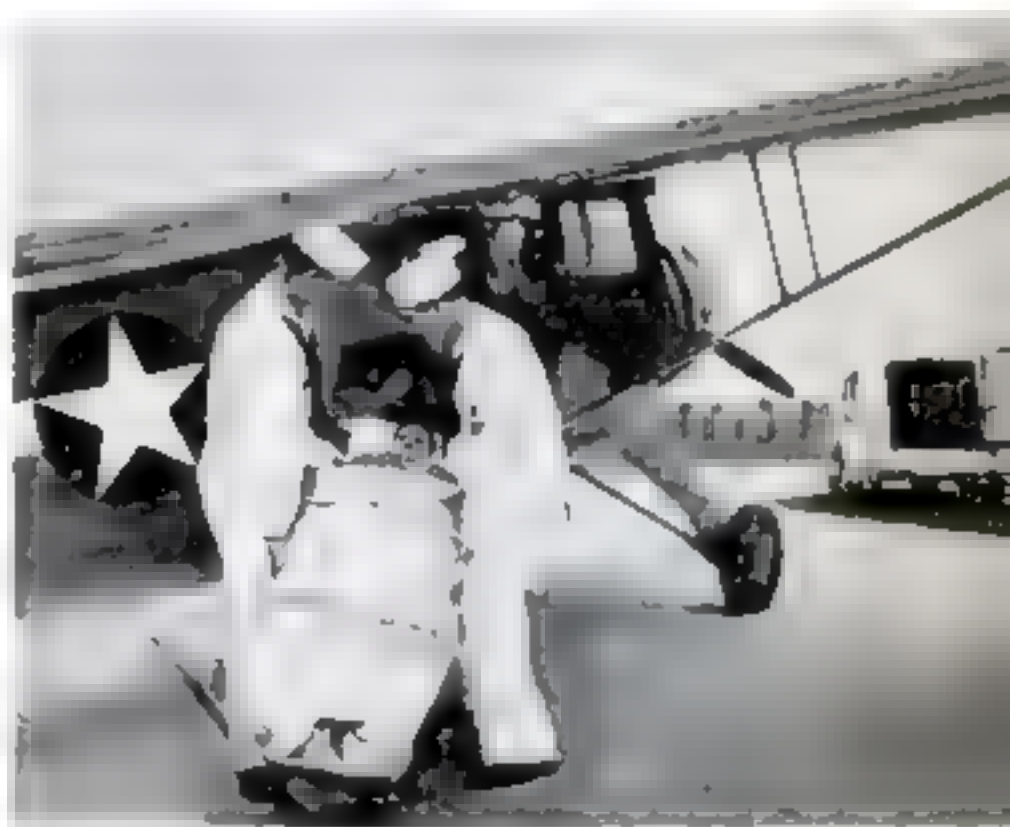
**LANCASTER IN CIVIES.** Proving that military aircraft can be converted to postwar transport use, this British Lancaster bomber conversion appears with altered tail and

fuselage. This sleek craft can carry 50 passengers, with baggage, in roomy comfort. It is the first postwar design from converted military aircraft.



**BRITISH GRASSHOPPER.** Built by Taylorcraft in England, this Auster III co-operation plane has done valiant service in many actions. It has a 130-hp. engine and does better than 125 m.p.h. The seats are side by side and controls dual. Transparent top gives all-around visibility. Span is 35 feet, length 22 feet, and height 7 feet.

**SHUTTLE AMBULANCE** for Navy and Marine casualties carries two badly wounded men in form-fitting wire stretchers loaded through a special door, right. Crew includes pilot, copilot, and nurse. This plane, named the Howard-Nightingale (after Florence Nightingale, the first war nurse), was basically designed by Ben. O. Howard, famous race pilot. It can operate 200 miles from its base. Engine is 450 hp.





# Controlled Sound...

**How music is used as an emotional powerhouse to spur weary workers and heal nerve-shattered fighters.**

**By JACK O'BRINE**

**T**HE young naval lieutenant sat staring into space. He'd been doing it for days. Now and again the corners of his mouth twitched; his frown deepened. He seemed oblivious of his surroundings. Since they flew him here from that Pacific battle area, he hadn't spoken. He just stared and, as he stared, a small group of nurses and musicians began to sing softly at the far end of the psychiatric ward. Unseeing, and unnoticed by the singers, he shifted uneasily in his chair. Then a strange thing happened.

Mrs. Harriet Ayer Seymour, director of the National Foundation of Musical Therapy, tells it this way: "When we played and sang, we hit some remembered theme, perhaps. At any rate, the young officer looked up. His eyes focused for the first time since he'd been at the hospital. Then he walked over and shook hands with one of the singers. He was started on the road to recovery. We had helped him."

Thousands of our fighters now find their way out of the fog of "traumatic neurosis"

—commonly known as shell shock—with the aid of music. It's becoming a vital part of the treatment at military hospitals, a potent partner of wartime medicine. And we can chalk it up as the second major achievement of controlled sound since that raucous trio of Hitler, Hirohito, and Mussolini forced us into the fray.

For months now, war plants the length and breadth of the land have been humming to tunes that make happier workers and increase production. Music in American industry soon may become mandatory, as it is in Great Britain. Scientists are proving to us that sound can be one of the dominant forces in our lives. Some of their claims for it are: Improvement of our sight and sense of smell; speeding respiration and pulse rate; raising body temperature; increasing muscular energy; reduction, delay, or increase of fatigue; instilling fear or building confidence; causing laughter, sadness, even ~~more~~.

Try, for instance, taking your pulse while you sing. Now change the tempo of the song, and you'll note an immediate change in pulse rate. Place before you a card with a smear of red paint on it. Gradually dim the lights until the red appears to be black. Turn up the lights slowly and note the point at which you're able to distinguish color. Now try it with your radio tuned to a waltz. You'll discover that with music your eyes pick up the red more quickly.



The emotional effect of hearing the voices of such stars as Gary Cooper and Ingrid Bergman, shown here in a scene from "For Whom the Bell Tolls," has been known to increase the body temperature of the spec-



# New Wartime Tonic

Before Pearl Harbor, our big defense plants were wary of sound-equipment salesmen. "You're crazy!" one manufacturer blurted. "Next you'll be wanting us to serve highballs." But that attitude now is as dead

as isolationism. Nearly 5,000 factories have installed music to work by. Sound application in industry has itself become a great industry.

Many of us are playing a part in sound

## WHICH OF THESE SELECTIONS WOULD YOU CHOOSE TO HELP PEOPLE WORK BETTER?



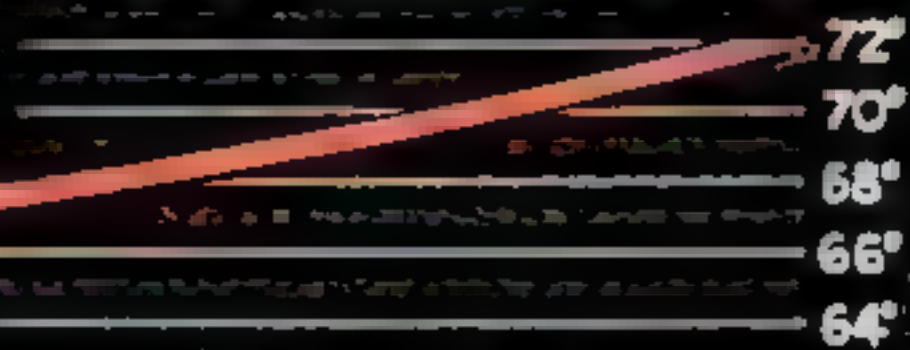
Experiments show that some kinds of music speed production in war plants, while others retard it. Paired below are alternative selections. Select those you think would be best to play, then check your answers on page 226.



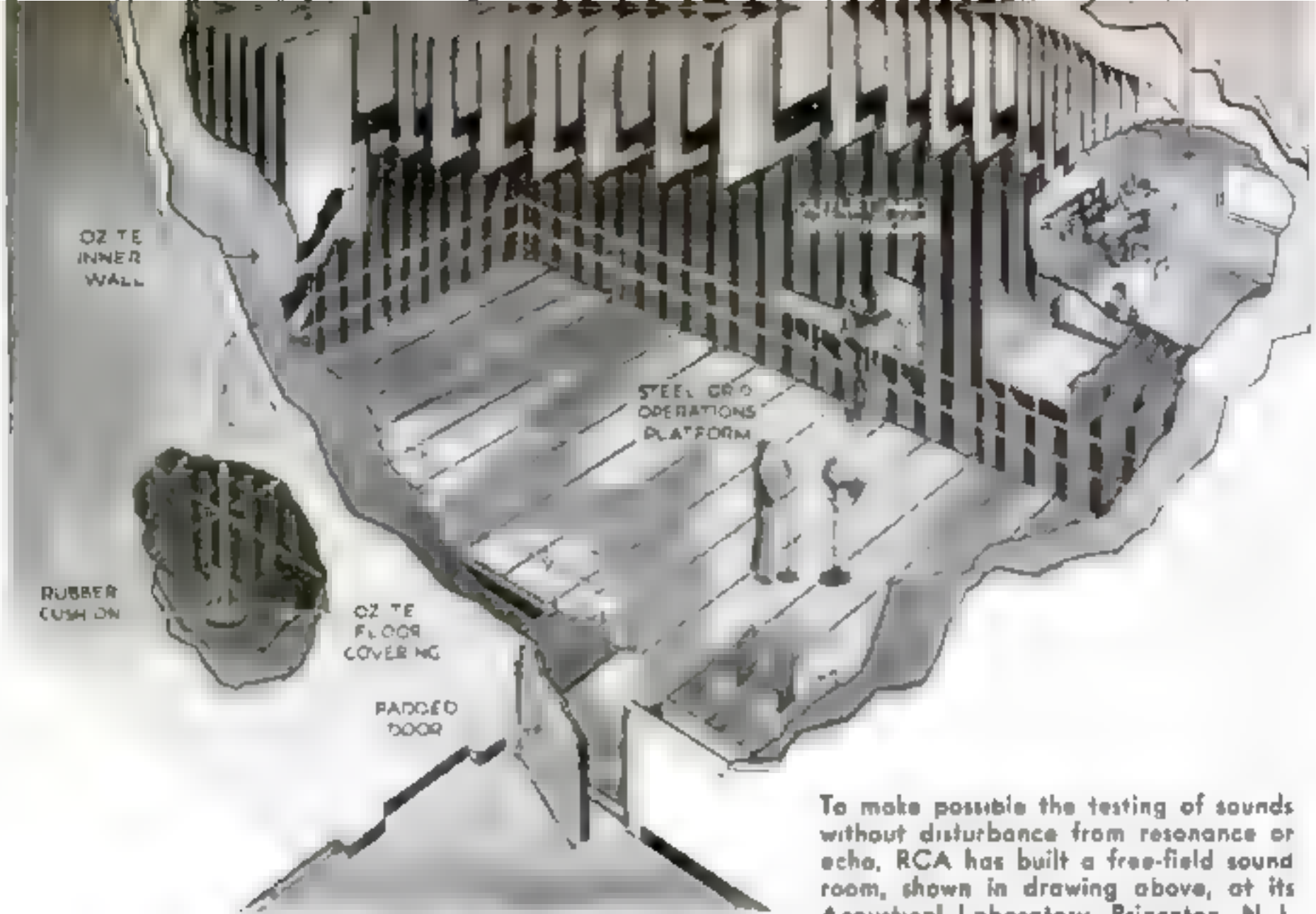
- |  |   |
|--|---|
| 1 { "Semper Fideles"<br>"Hike Notre Dame"                    | 6 { "Wreck of the '97"<br>"Sweet Lullaby"                       |
| 2 { "Nearer My God to Thee"<br>"You Are My Sunshine"         | 7 { "The Star-Spangled Banner"<br>"Ain't Sweet Mystery of Life" |
| 3 { "Merry Widow" Waltz<br>"Beer Barrel Polka"               | 8 { "Irish Washerwoman"<br>"One Alone"                          |
| 4 { "William Tell" Overture<br>"Remember Pearl Harbor"       | 9 { "Home on the Range"<br>"Tiger Rag"                          |
| 5 { "Auld Lang Syne"<br>Tchaikovsky's "Piano Concerto No. 1" | 10 { "Brazil"<br>"Why Do I Love You?"                           |



taters so much as to raise the temperature of the theater eight or 10 degrees







research without realizing it. For only by observing our reactions can science find out what to expect from different types of sound. Hundreds of persons in schools, factories, and public places have been "tapped" for sound effect.

In one instance, sound researchers seeking to discover the difference in audience reaction to jazz and classical music leased a large hall in New York. They wired it so that they could record heartbeats, pressure grip of chair arms, and foot tapping of a cross section of the audience. Moreover, they recorded facial expressions with hidden cameras. The musical program consisted of two jazz numbers and two classical pieces played 25 times each. At first the jazz increased the pulse rate by  $2\frac{1}{2}$  beats a minute, while grip strengthened two percent and tapping jumped six a minute. But, as the last jam number jived to an end, grips had wilted and tapping long since stopped. The classical music, on the other hand, got only a mild reaction at the start but wound up ahead in popularity, stimulating both pulse and arm gripping.

In a Brooklyn junior high school, 1,500 students contributed unknowingly to sound research when they increased the temperature of the school auditorium 15 degrees during a lively session. It was a cold day. The building superintendent took pains to have the auditorium amply heated. As an added precaution, he was on hand to check thermometers. His amazement mounted

with the mercury as the program approached its climax. He noted that with every exciting song and speech the room got warmer. His findings went to other building superintendents, including a man in charge of one of the world's largest motion-picture theaters. Now scores watch thermometers, alert to sound that may send temperatures rocketing.

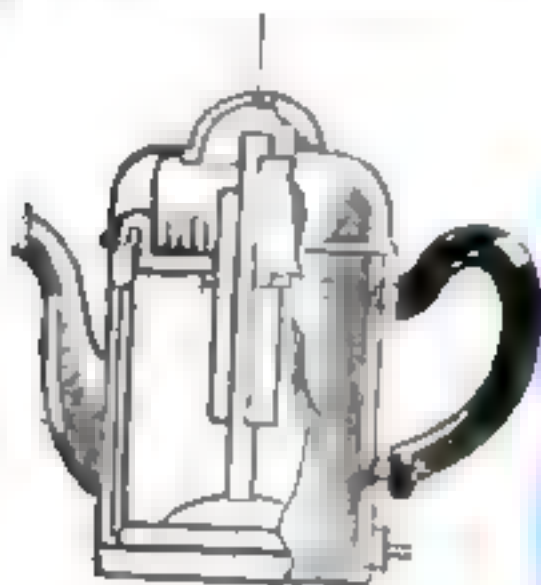
Such incidents come to mind when sound experts tackle problems in our daily life. The important thing in providing music to work by is to maintain emotional and physiological control. That means not only creating an atmosphere conducive to enjoyment but actually relieving fatigue. Most helped are the employees doing light, repetitious tasks on the assembly line. They expend great quantities of nervous energy combatting monotony. Music properly applied acts as a mental tonic, driving out fatigue and boredom on notes of song. The job then takes on new importance, accidents decrease, absenteeism drops, morale mounts. Moreover, it has been noted that introduction of music puts an abrupt end to strife and bickering among employees.

But there are pitfalls in sound application that can prevent these good results. To root these out and spotlight them for the guidance of war-plant managers, Stevens Institute of Technology, Hoboken, N. J., has worked closely in experiments with RCA and Muzak, chief suppliers of sound equipment in industry. *(Continued on page 226)*



## new ideas from the inventors

**A GOLF CLUB** with an adjustable head solves the caddy problem of the wartime golfer, formerly weighed down by a heavy bag. Invented by Charles V. Winter, of Barrington, Ill., the club has a notched shoulder at its shank end, to which the head is secured at the proper angle by a fast-operating nut. Transformed into a mashie, niblick, and so on, it can even be used in reverse by left-handed golfers.



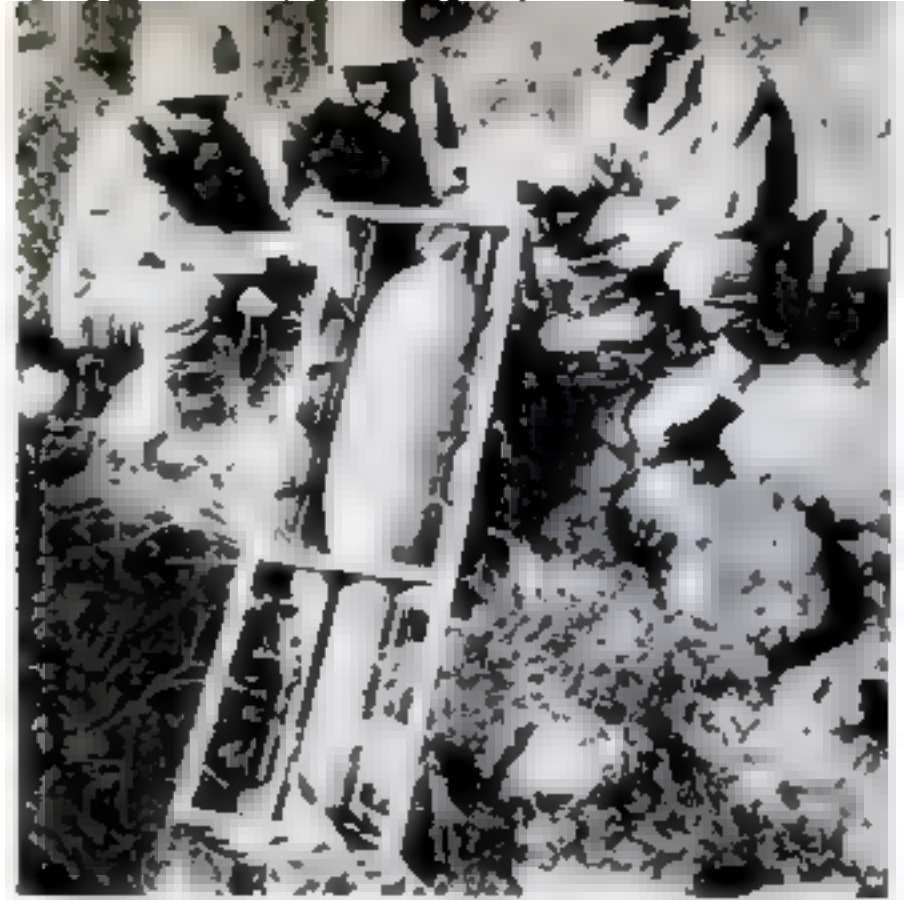
**GREEN COFFEE** can now be roasted an instant before brewing in a combination roaster and percolator designed for epicures by Gustave L. Kayden, Woodmere, N. Y. Gas or electricity heats the device, roasting

the raw coffee in an upper compartment and heating the water in a lower one. By the time roasting is done, the water has boiled and, passing upward through a pipe, filters down through the grains.

**DARNING** is made easier by an illuminated plastic darning egg. Material to be mended is stretched over a supporting head, which contains a small light bulb powered through a cord from a convenient outlet. The hollow handle holds yarn, needles, and thimble. Alonzo J. Bloodgood, of Middlebury, Conn., is the inventor.







**TRYING OUT ROCKETS** as antiaircraft and incendiary shells, Germans have produced the captured weapon shown above. The odd missile is fired from the crate in which it is shipped.

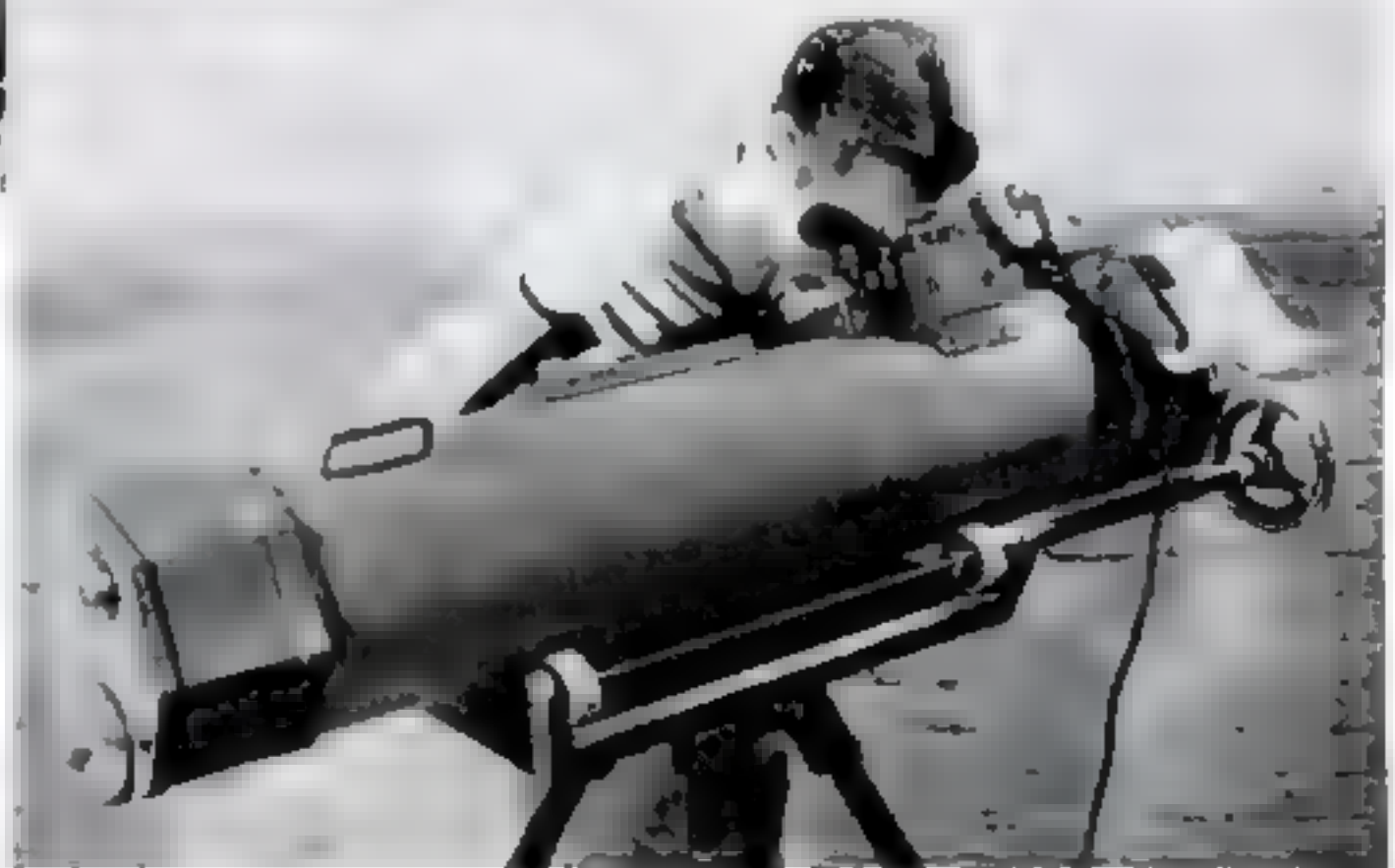
**MANNEQUINS OF PLASTIC** serve as models for designing planes and airmen's costumes. At left, one of the transparent figures is being fitted with a winter flying jacket. Others test cockpit and turret dimensions.



**ANTIAIRCRAFT MEN** now learn height and range finding with improved "stereoscopic trainers." Gazing through twin eyeieces at a target, such as a maneuvering plane, a student tries to keep the images combined and in focus with hand controls. His automatically recorded score helps him to correct errors.

A real antiaircraft height finder, like this one seen in action in the South Pacific, is an extremely difficult instrument to make

This stereoscopic trainer operated in the same way, releases real ones for combat use. The tape at far right records user's score





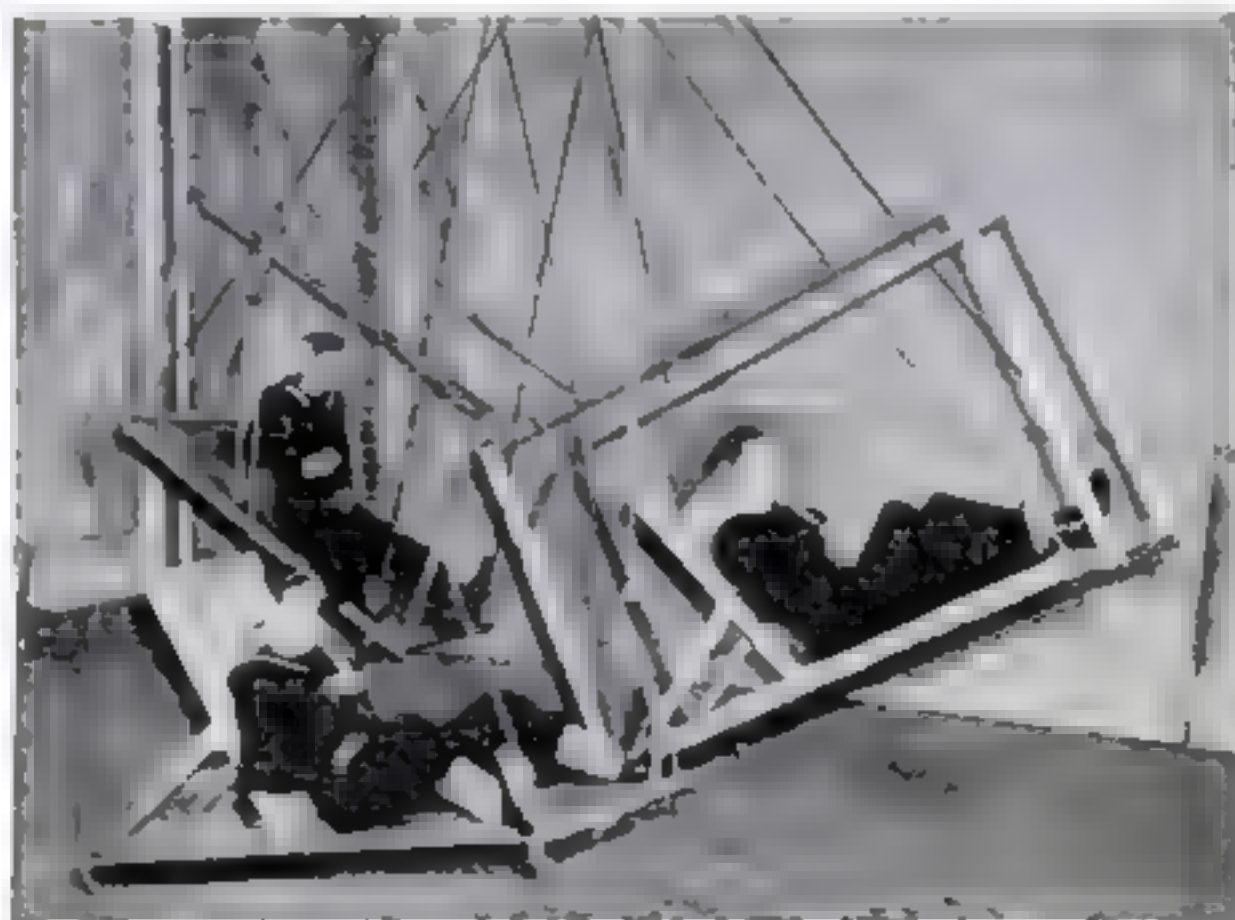
Health-building foods, right, often absent in prison fare, are featured in the "invalid package" sent by the American Red Cross to ailing Yanks in enemy prison camps.

Volunteer workers pack the boxes at a Red Cross depot in New York City. Cigarettes and soap are among the items that prisoners prize highly.



**AMERICAN WAR PRISONERS** who are recovering from wounds or illness in enemy camps now receive special food packages every week through the American Red Cross. The "invalid" package differs from the standard food package in that its contents, shown above, are specially selected for their value in building up health. Its weight is approximately the same as that of the standard package.

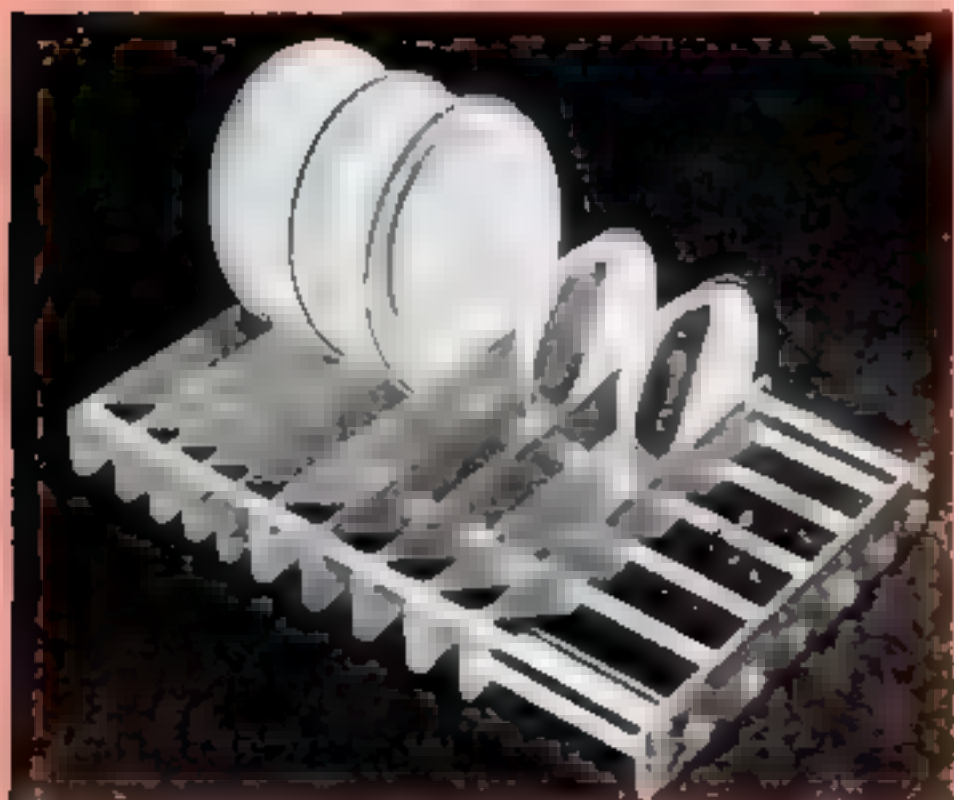
**SEASICKNESS** is now cured in three out of four cases with pills developed by the Royal Canadian Navy and the Montreal Neurological Institute. Aiding the research were sailors who swung on platforms, at right, which efficiently developed all the symptoms of this ancient ill. The new pink pills are effective for eight hours. Taken two hours before sailing or in rough weather, they will greatly help in landing invasion troops on their beachheads in good fighting condition.







LARGE POCKETS for holding polish, cloths, or cleaners are sewed into this special apron



ALL-WOODEN DISH DRAINERS like the one above are assembled with waterproof glue and finished with a durable coat of clear varnish

WATER IS AERATED as it passes through the ingenious faucet nozzle shown at the right in 1/1000-second action photos and a close-up. First broken into spray by a perforated disk, it draws air through intake slots in the side of the nozzle and is mixed in going through a fine mesh. The entrained air makes the water produce rich lather and rinse quickly, and the bubbles render it splashless, as in the photos at right of water gushing on a light bulb . . .

## AIDS TO *Modern Living*

PROTECTIVE LACQUER that keeps bright metals from tarnishing is now available in a brush-top tube. The unit is especially useful for lacquering small objects



. . . and above flowing into a glass. These big bubbles vanish immediately and leave the water clear. The device is scheduled for production on the lifting of priorities. Its principle has been used also to homogenize milk, to whip table cream, and also to mix liquids in an emulsion





**THIS PORTABLE DRYER** can be taken apart and packed in a 10 1/2" by 8 1/2" box, or tucked away in a traveling case. It weighs only 8 oz., but will hold a lot.

**MENDING TAPE** of the press-on type can be obtained in a grade heavy and strong enough to patch tears in awnings and other stout canvas materials. Water-repellent, the tape can be used also on torn raincoats. It is applied with a hot iron.



**YOUR FINEST PLATES** can be displayed safely for all to admire on a sideboard or shelves if you stand them upright in these little holders made of a white plastic.



**JUICY RETURNS** can be expected from this orange squeezer made all of wood except for its fluted porcelain reamer. Its blond, highly polished finish makes the squeezer good looking enough to be used in the dining or living room and grapefruit, lemons, and limes can all be pressed dry in the gadget with ease. Holes in the reamer strain the juice.

**QUICK-CHANGE ARTISTS** will marvel at the speed with which you can swathe Junior in these soft paper diapers. Just snip them from a roll, arrange them in a special knitted covering, and encase the baby in a jiffy.





# Trouble-Shooting with a

## SIMPLE CHECKUPS HELP YOU TO FIND ELECTRICAL FAULTS AND LOSSES THAT CAN CAUSE MYSTERIOUS AUTO AILMENTS

By Ralph Rogers

**I**F AN experienced auto mechanic could have but one instrument to aid him in diagnosing electrical troubles, the chances are that he would pick a voltmeter. Properly used and interpreted, it can help in locating many annoying car ailments—hard starting, dim or overbright lights, undercharged battery, and similar difficulties—which might otherwise be hard to track down.

As a trouble-shooting tool, a voltmeter is preferable in most cases to an ammeter because wires and connections do not have to be disturbed. When an ammeter is used for testing, the cause of a difficulty is sometimes removed when the ammeter is connected, with the result that the repairman does a little head-scratching. Similar puzzlement may occur when the trouble comes from a loose connection at the point where the ammeter is placed in the circuit. The difficulty disappears after the repairman restores the connection snugly, but he is still in the dark about just how he fixed it.

The difference between an ammeter and a voltmeter is that the former measures the quantity of current flowing through a cir-

cuit, while the voltmeter indicates the pressure available to push it along. The current actually flowing through a circuit is wholly dependent on voltage. In other words, no voltage, no current; low voltage, low current; too high a voltage, too much current. It is this fact which makes the voltmeter so useful an instrument, for if it indicates that insufficient voltage reaches a certain electrical unit, insufficient current passes there too.

There are two basic ways to use a voltmeter in automotive testing. The first is to connect it across a circuit, whereupon it indicates the total voltage at that point. The voltmeter in the photo on the facing page is being used in this way to test one cell of a storage battery.

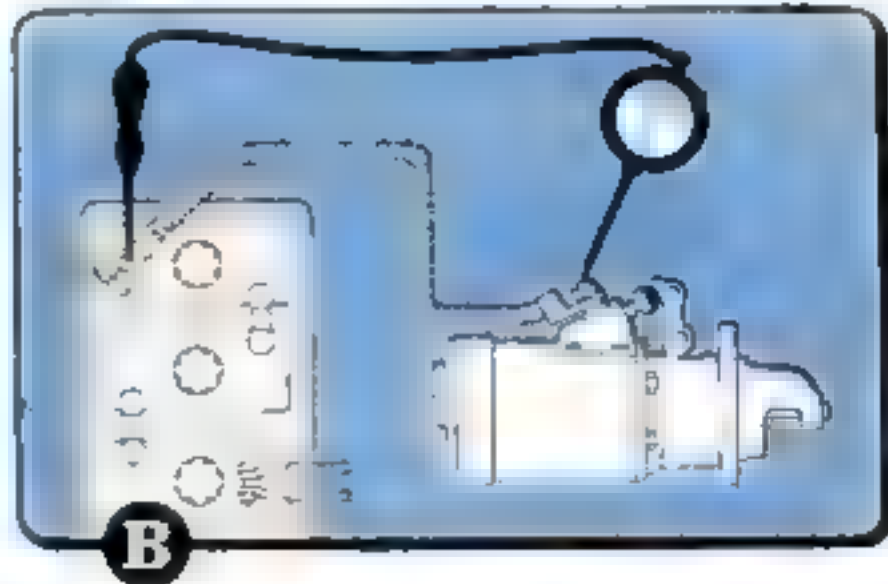
If the meter is connected in parallel with part of a circuit in which current is flowing, it then indicates the voltage drop, or loss of electrical pressure, in that portion of the circuit. When connections are clean and tight, and when the wire is in good condition and of proper capacity, there will be almost no voltage drop and the meter will read close to zero. But if there is any defect in the electrical conductors, the resistance created will cause a larger voltage drop. The best conductor in the world will cause some drop, but in autos any reading higher than .2 volt is worth investigating.

The handiest type of voltmeter to use is one which has a dual range—one scale reading from minus .5 to plus 3 volts in graduations of .1 volt, and the other scale reading from zero to 10 volts in graduations of .2 volt. Either range is available by the use of

## HOW TO TEST THE CIRCUITS OF A CAR IN ORDER TO TRACE



Use these connections in testing a battery ground strap for voltage drop. Read the low scale of the meter when the starter is turning. If the drop is more than .1 volt, there is excessive resistance



To check the starter cable and its terminal connections, try this test with the starter in use. The reading, on the low scale, should not be over .1 volt. Place prods on the terminals, not the lugs



# Voltmeter

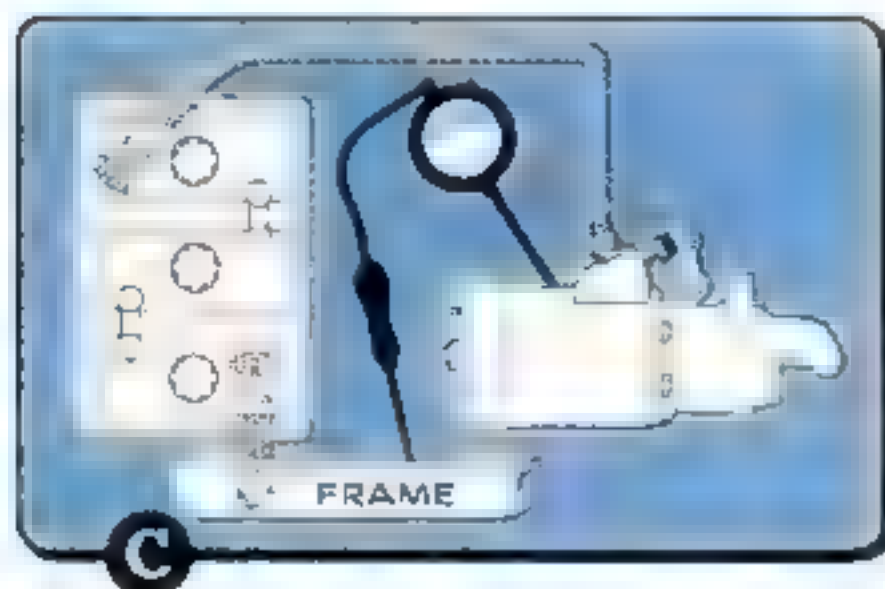
a button on the instrument. Form the habit of testing first with the high range—that is, without pressing the button—and then, if the reading is less than 3 volts, use the lower range. Otherwise excessive voltage may damage the instrument.

In practically all cars, a grounded-return wiring system is used, with the chassis acting as a path for completion of the circuits. Therefore the battery ground strap, connected to the engine, transmission, or frame, is an integral part of the electric system and should not be ignored in your tests.

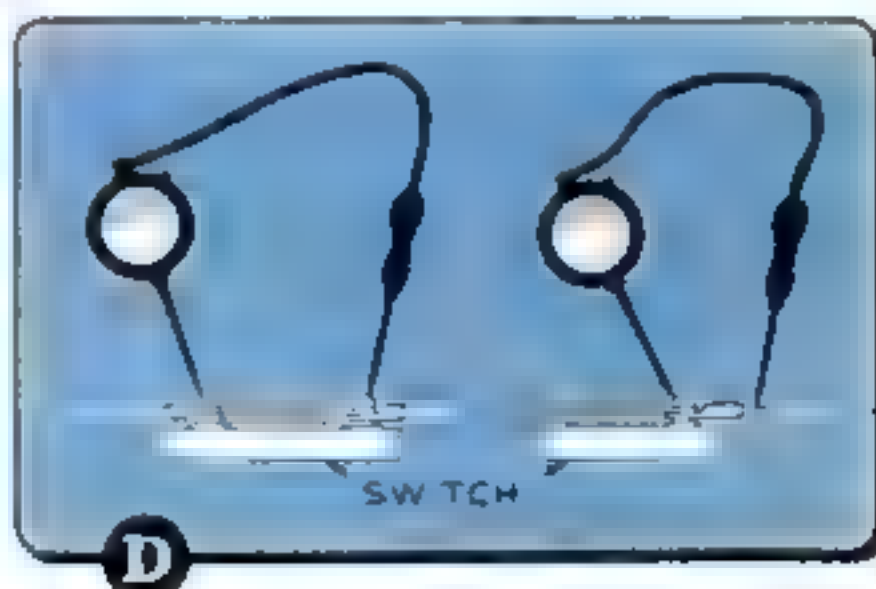
Don't depend on visual inspection in checking for loose connections, corroded terminals, and frayed or partially broken wires. Instead, test the major circuits for total voltage, and if the amount appears insufficient, work back along the circuit until you find the place or places where the voltage drop occurs. If all connections are sound and a serious drop still results, look for either a partially broken



## HIDDEN DEFECTS THAT INTERFERE WITH GOOD PERFORMANCE ➡

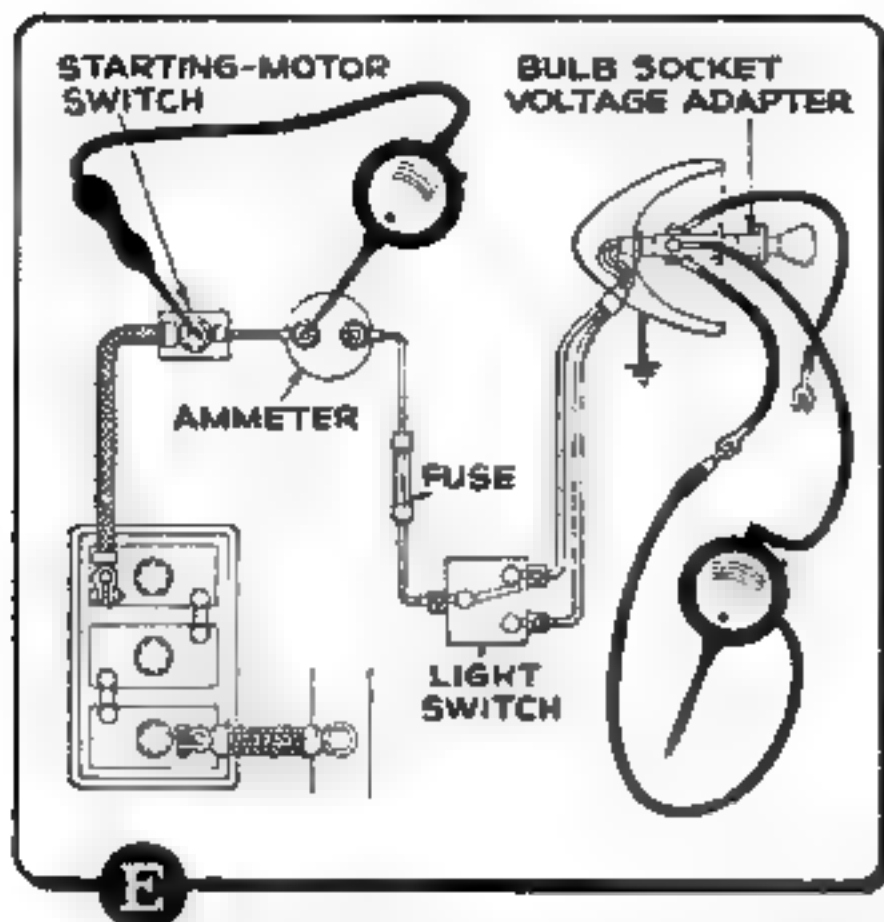


A voltage drop between the starting motor and the ground, although uncommon, can cause poor starter performance. With the starter turning and the low scale in use, the drop must be less than .1 volt

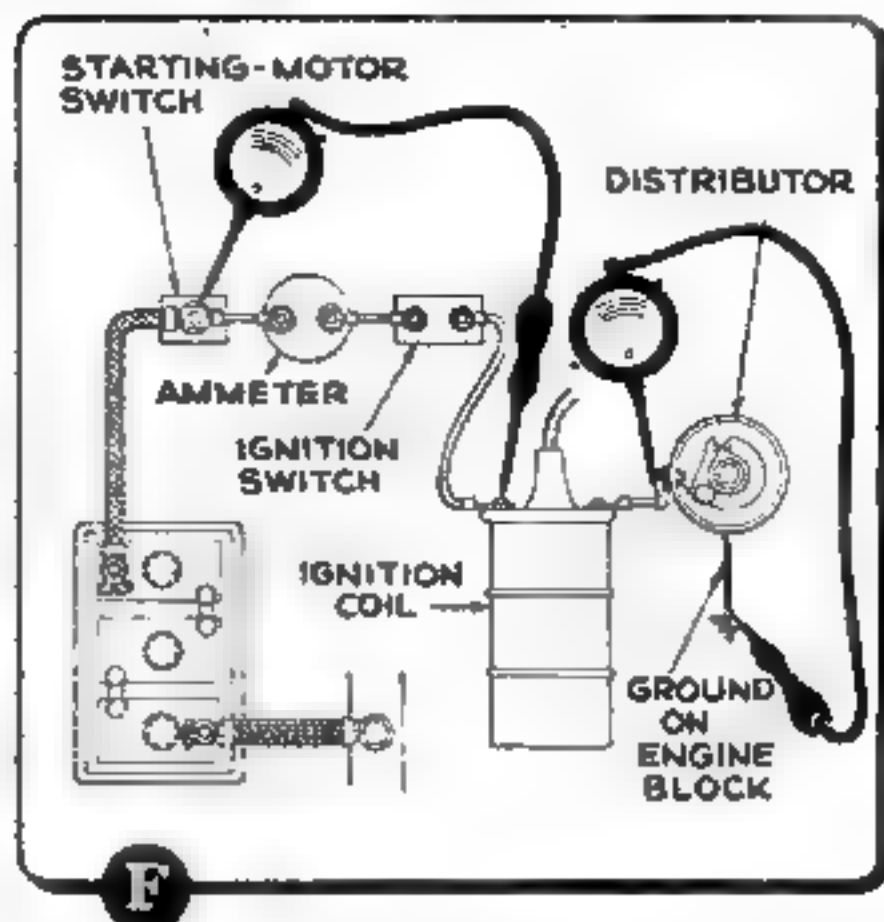


Poor contact within a switch is detected as shown at the left above. Use the low scale and be sure the switch is closed; the drop shouldn't be more than .2 volt. Test each terminal as at the right





Left, the battery-ammeter line is tested; the drop should be under .2 volt. Use a bulb-socket adapter to check headlight voltage with the bulb lighted. The allowable drop varies with candlepower of the bulb. With a 21-c.p. bulb, the reading should be at least 5.6 volts; with a 32-c.p. bulb, 5.4 volts; with a 50-c.p. bulb, 5.1 volts. In a sealed-beam light, make connections directly behind the unit



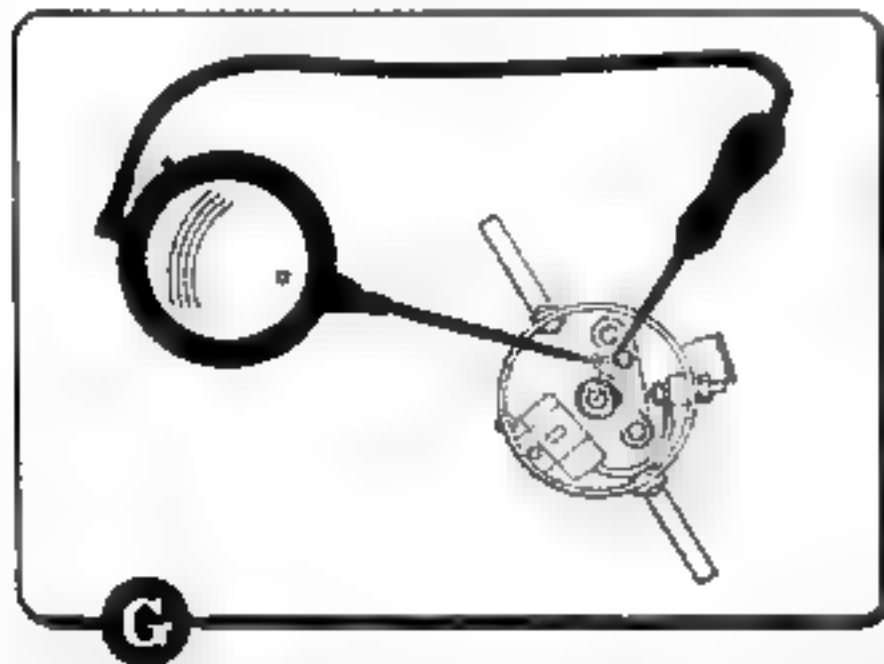
Voltage drop in the primary ignition circuit may be checked by the method shown at the left above. Turn on the ignition and be sure that the points are closed. The low-scale reading should be under .2 volt. To test the total voltage in the primary ignition circuit, use the meter as at the right. If the high-scale reading is 6 volts or more with the ignition on, the circuit is in good condition

wire or one of inadequate carrying capacity.

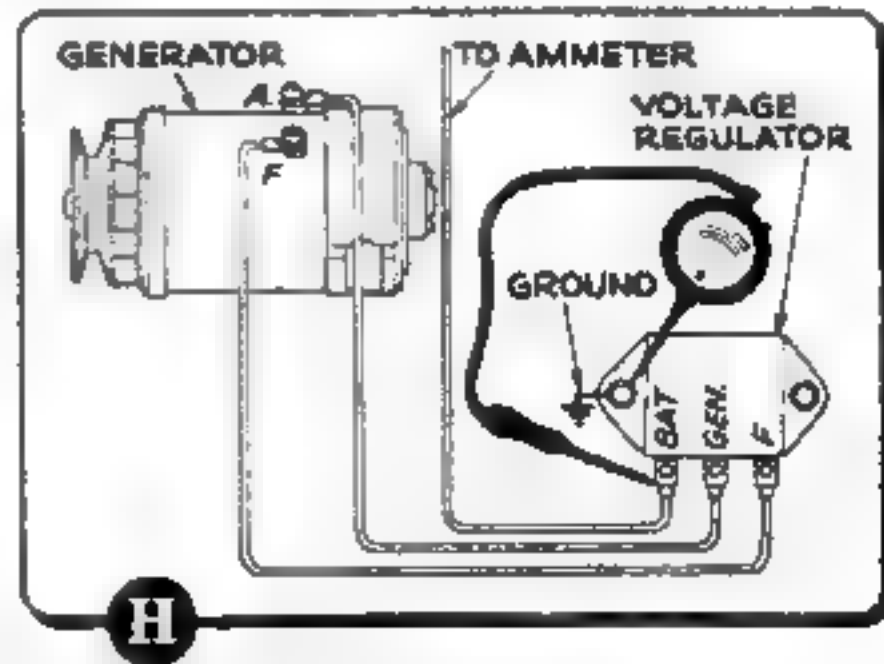
In testing your battery with a voltmeter, check each of the cells individually, as shown in the photo on page 135. The reading for a fully charged battery should be 2 volts or better at each cell. But since the voltage is only a trifle less in a partially discharged battery, it's necessary to place a load on the battery to determine its true condition. Crank the engine with the starter—with the ignition off to prevent it from starting—and repeat the cell tests. If the readings are over 1.7 volts in summer or 1.5 volts in winter, the battery is in good condition. Incidentally, a difference of more than .2 volt between cell readings may mean that

the battery needs recharging or that it has outlived its usefulness. Take the battery out and give it a high-rate discharge test to determine which is the case.

The accompanying drawings show how to check some of the main car circuits. Remember that in checking voltage drop across a switch, the switch must be closed and the current flowing. And don't forget, in testing lighting circuits, that high voltage can cause as much trouble as low. If you do find excessively high voltage, it may be caused by an overcharged battery or an excessive generator charging rate; it may also have its origin in loose connections between the generator, ammeter, and battery.



With the distributor points closed and the prods placed as shown, voltage drop between the points may be measured. Turn the ignition on and use the low scale. The reading should not exceed .2 volt



For a voltage-regulator test, run the motor at a fairly fast speed and make sure the regulator is warmed up. If the high-scale reading differs very much from 7.5 volts, adjustment may be called for



# AUTO Ideas

**A PORTABLE HOIST** capable of handling 8,000-lb. planes has been developed for use on 2½-ton Army trucks by Lieut. Col. James H. Reed, Jr., of the Air Corps. Designed for winch-equipped vehicles, the hoist is made principally of two lengths of 3½" iron pipe and a wire cable which anchors it to the truck. The hoist rests on the front bumper, and the cable extends from the apex of the hoist to the rear of the truck, where it is fastened with clamps. Brackets at the side of the truck carry the hoist when it is not in use.



**WOODEN BUMPERS** made of laminated maple bonded with a resin adhesive, like the one at the left, have been subjected to tests that indicate they will withstand an even greater shock than comparable steel bumpers. As an additional advantage, it is claimed for the wooden bumpers that they can be polished very quickly if scratched. Even chunks chipped out of them can be replaced and the scars hidden beneath a new finish. The weight of the laminated type is slightly less than that of steel bumpers.



**THIS CAR-TOP RACK** is held securely in place on top of the car by ½" by ½" steel clamps that clutch the roof gutters and are drawn taut with turnbuckles attached to ½" cables. The cables are passed through screw eyes installed along the inside length of two 1" thick wooden transverse supports. If these supports are made to conform to the contour of the car top, they can be secured firmly with a minimum of tension. Glue felt or some other soft material to the bottom to protect the car finish. The platform is made of 1" by 3" pieces spaced 3" apart. Paint the unit to match the car.—E. W. L.



## Think-OF AN IDEA!

If you would like to let others know about your pet auto tip—and get paid generously for doing so—just write your idea in 100 words or less, draw rough sketches, and send them to the Automobile Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York 10, N.Y.

**ANTIFREEZE SOLUTIONS**, used all last winter and saved for re-use this season, can have their rust-inhibiting properties restored by the addition of a chemical inhibitor originally developed for the Army and recently made available to the public. Although the new compound does not contribute to the antifreeze properties, it does neutralize those solutions that have become acid through extended use. When treating a solution, it is advisable also to filter it in order to remove dirt and rust particles which might impair cooling-system efficiency.



A spurt of bubbles danced to the surface of the pail of water. "Stop your engine," Gus called



# GUS FINDS TROUBLE IN BUBBLES

By MARTIN BUNN

"MAWNIN', Mistuh Wilson." Gus Wilson looked up from his workbench and saw Peter Jackson, the likeable colored truck driver, standing just inside the doorway of the Model Garage shop.

"Hello, Peter," said Gus. "What's the matter now? Is that old rattletrap of yours acting up again?"

Peter shook his head. "I ain't drivin' that

ol' truck no mo'," he said. "Mistuh Dill, he promoted me to a two-ton."

"That's fine," Gus told him. "Well, what's the matter with your two-ton?"

"There ain't no one know," Peter said gloomily. "That's why Mistuh Dill tole me to bring her over here to you-all. He's a-comin' hisself, sho'tly . . . Here he is now."

John Dill, who has charge of the Johnson and Fredericks trucks, came into the shop.

"How're you doing, Mr. Dill?" Gus greeted him cheerfully.



"Apparently not very well," Dill said grouchy. "We've been having a little difficulty locating some cooling-system trouble in the truck that Peter here drives. I hadn't given up on it by any means, but last night Mr. Fredericks heard about it somehow, and told me I'd better bring the truck over here and ask you to take a look at it . . . Mr. Fredericks is the boss—and it seems like you're the champion trouble shooter of these parts!"

Gus saw why Dill was miffed, and sympathized with him. "Oh, Mr. Fredericks was just acting out of old habit," he said lightly. "You know we used to take care of the Johnson and Fredericks fleet back in the days when it consisted of one truck, and when Fredericks thinks of trouble now, he still thinks of me. I'll check over the job with you, just to satisfy him."

Dill grunted, somewhat mollified. "Well," he said, "two heads are better than one."

Gus nodded diplomatic agreement. "Cooling-system trouble, you said?" he suggested.

"Yes," Dill told him. "Tell Mr. Wilson what happens every morning, Peter."

"It's thisaway, Mistuh Wilson," Peter said. "When I starts mah motor in th' garage in th' mawnin', she runs fine. First job I do ev'ry day is take a load up to th' freight depot. That's only half a mile, but befo' I gets there mah motor's all hot up, an' when I stop, a lot of water runs outa th' radiator overflow pipe. After that mah motor gets hotter'n hot, an' befo' long I gotta put a li'l mo' water in th' radiator. An' then I gotta keep on puttin' a li'l mo' water in it ev'ry couple of hours all day long."

"That darned truck," Dill said, "is wasting two gallons of antifreeze a week. Drive it in, Peter."

As Peter drove the truck into the shop, Gus's educated ears told him that its engine wasn't running quite perfectly. He took off the radiator cap. "No sign of overheating now," he remarked.

"No, suh, Mistuh Wilson," Peter said. "I ain't been up to th' freight depot yet—that's why!"

"Nonsense!" Dill snapped. "What could going to the freight depot have to do with your engine overheating?"

"Mebbe," Peter said fearfully, "dat freight depot's got a hoodoo on me!"

"Nonsense!" Dill said again. "Well, Mr. Wilson—any bright ideas?"

"Not a one, so far," Gus confessed cheerily. "In a case of overheating, the first things I always check for are late ig-

nition timing and too lean a fuel mixture, but I suppose—"

"You suppose dead right," Dill assured him, rather unpleasantly. "The first thing I checked was the ignition timing, and the second thing was the carburetor adjustment. They're both O. K."

Gus nodded. "Then there's the radiator core," he suggested. "When the coolant runs out of the overflow pipe, it's often an indication that there's a stoppage of circulation somewhere between the upper tank of the radiator and the intake of the water pump. Usually it's caused by the radiator core being stopped up."

Dill sneered. "That radiator's as clean as it was the day this truck left the factory. I had it checked as soon as this overheating showed up, and I had the core thoroughly flushed out. The radiator's O. K., I tell you—I'll bet you anything you like!"

Gus grinned. "I'm a poor gambler—I never bet unless I'm certain," he said. "Well, let's see, now . . . How about the thermostat? Sometimes that little bleeder hole—the one that lets the air out when you're filling the cooling system while the valve is closed—gets clogged up. When that happens, pressure from the heated water builds up behind the thermostat until all of a sudden the hot water acts on it, the valve pops wide open, and the coolant gushes up through the radiator and out of the overflow pipe."

Dill let Gus finish. Then he said: "That's real interesting, Mr. Wilson. It might happen, of course—but it didn't happen with *this* truck, because we put in a new thermostat when we first had trouble, and it didn't do a bit of good."

"Peter," said Gus, "switch on your engine again, will you?"

Peter climbed into the cab, switched on the ignition, stepped on the starter, and allowed the engine to idle. Gus listened intently for a few seconds, shook his head in a disappointed way, and signaled Peter to stop the engine.

"It doesn't sound the way it did when he





drove the truck into the shop," he said, more to himself than to Dill. He scratched his left ear as he did a half minute of hard thinking. Then he said to Peter: "How does your truck act when you've got a full load on it, or when you're pulling up a hill? Has your truck got plenty of power?"

Peter shook his head. "No, suh, Mistuh Wilson, she ain't got th' pep what a fine bang-up truck like this here one ought to have. I done told Mistuh Dill that, but he says there ain't nothin' at all th' matter with the way she pulls."

"Just imagination!" Dill said angrily. He turned to Gus. "You were listening to the engine a minute ago. Did you ever hear a truck engine run any smoother?"

"I never heard one idle any smoother," Gus said. He raised his voice and called: "Hey, Stan!"

Stan Hicks, the grease monkey, emerged from the stockroom.

"Jack up the rear wheels of this truck, will you?" Gus said. Then he went over to his workbench and reached down a short length of rubber tubing from the shelf above it.

"She's jacked up, boss," Stan reported.

"O.K.," Gus said. "Now get me a pail of water."

Stan brought him a pail of water. Gus set it on the floor near the front end of the truck. Then he carefully worked one end of the tubing over the lower end of the radiator overflow pipe on the truck and submerged the other end of the tubing in the pail.

"Start your engine," Peter," he directed. Peter climbed back into the cab and restarted the engine. Gus was staring at the water in the pail. "Let her idle," he said. "Now put her into gear."

The truck's rear wheels began to revolve. Dill stepped over beside Gus and also stared at the water in the pail. "What's all this?" he demanded. "Nothing's happening."

"Something is going to happen in a moment," Gus told him. "Keep your eyes on the end of that tube and you'll see it . . . Now, Peter, give her a little more gas. That's it. Now, when I tell you to, put on your brakes—not hard enough to kill your engine, but hard enough to make it work the way it has to when you've got a full load and you're pulling up that hill to the freight depot. Understand? O.K.—put 'em on!"

Peter applied the brakes, lightly at first, then harder. The engine labored against their drag. A spurt of bubbles danced to the surface of the water in the pail. Gus could not conceal his satisfaction as he waved to the truck driver.

"Stop your engine!" Gus called. Then he turned to Dill. "Get it?" he asked.

"I saw some air bubbles," Dill growled. "What do you make of it?"

"When air gets into a cooling system," Gus explained, "it displaces some of the cooling fluid, which runs out through the overflow pipe. Those bubbles in the pail prove that it is air in the cooling system that has been causing the loss of coolant, and making the engine overheat."

Dill stared at him. "Maybe you're right," he said grudgingly. "But if you are right, how is the air getting into the cooling system?"

Gus motioned toward the pail. "Our little test answers that question," he said. "Those bubbles coming in a spurt show that the air is coming from one of the cylinders—a compression leak. If the bubbles had come to the surface slowly and in a steady stream, they would have shown that the air was getting into the cooling system by way of the water-pump shaft or around a hose. When they come in a spurt, it's certain proof of a compression leak. The chances are a hundred to one that you'll find a leaky head gasket causing the trouble."

Dill did some more thinking. Finally he said: "I still don't get it. Why didn't the bubbles appear until Peter put on his brakes?"

"It often happens," Gus told him, "that a head gasket doesn't leak until the engine is under load or pulling up a grade. When Peter drove the truck into the shop, my ears told me that one of the cylinders wasn't acting just right, and he gave me another clue when he said that the trouble didn't show up until he'd taken a load up to the freight depot. Applying the brakes against the engine, with the rear wheels jacked up, had the same effect on the head gasket that a full load on the road or pulling up a hill would have."

"Well," Dill said ungraciously, "we'll see. I'll get in touch with you later."

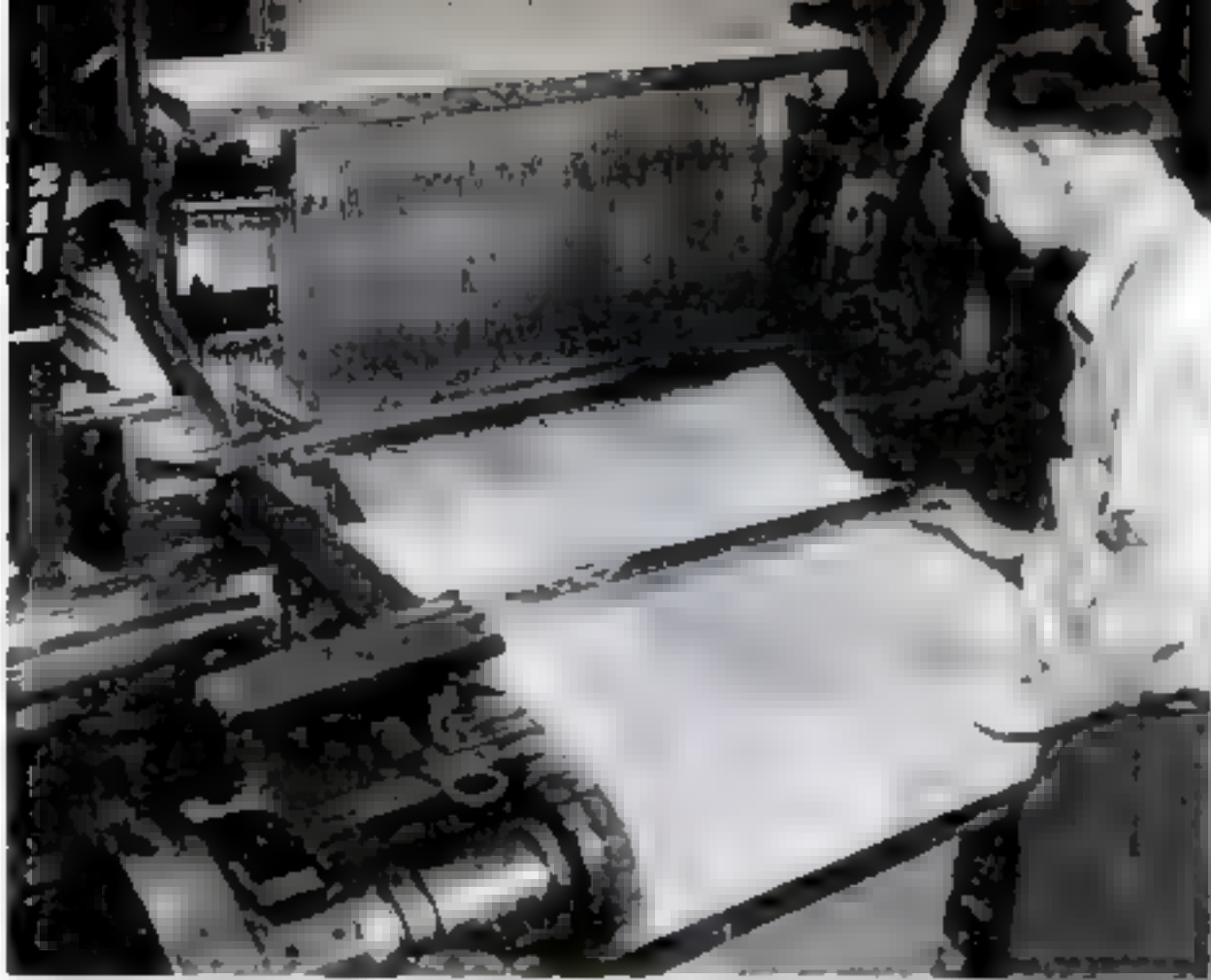
THAT afternoon Joe Clark called Gus to the office telephone. "This is Dill," the voice at the other end of the line said. "You were right—it was a leaky head gasket. You're a champ trouble shooter—I'll give you that!"

"Oh, I was just lucky—stumbled over it," Gus said modestly. "Dinner some night? . . . I'd be glad to . . . O.K. So long."

He replaced the receiver and turned to his partner. "Dill's stopped being sore at me," he said. "'A soft answer turneth away wrath'—who said that, Shakespeare or the Bible?"

"I wouldn't know," Joe said. "But don't you let an invite to dinner turn you away from making out a time slip for every minute on that job!"





Only minor mechanical modifications are required to convert a standard carpet loom for making the retread

## NEW TIRE RETREADS ARE WOVEN ON A CARPET LOOM

A TIRE retread of cotton and rubber woven together on a carpet loom holds promise of materially increasing the mileage to be secured from the national stockpile of reclaimed rubber. Road tests reveal that the carpet-type retread gives about 75 percent of the mileage given by a retread containing rubber alone, and needs but 40 percent as much rubber to do it. Thus while a standard retread ran 1,080 miles for each pound of reclaim, the carpet-fabric retread lasted 1,900 miles per pound.

Developed by the Alexander Smith & Sons Carpet Company, Yonkers, N. Y., the fabric is composed of lengths of rubber, extruded around a cotton cord by the same kind of machine used for insulating wire, and then woven with cotton cords. The result resembles an uncut pile carpet. A standard Jacquard loom is used, modified slightly to handle the springy extrude.

The fabric is applied to a tire carcass in the same manner as the camelback or thick strip of rubber used to give body to an ordinary retread; it is cemented in place, covered by a strip of cushioning rubber, and the whole tire is then vulcanized until the cords are thoroughly impregnated with rubber. In the course of tire wear, the ends of the yarn are worn through, leaving an antiskid surface. As with other retreads, speeds higher than 35 m.p.h. are not recommended with these tires.



The carpet-pile fabric is vulcanized to a tire in the same way as an ordinary retread. Below is the fabric before and after thousands of miles of use. The worn ends of the cotton yarns reduce skidding





# HOME AND WORKSHOP





## GRACEFUL THREE-LEGGED

# Utility Stand

IS BUILT FROM A CHOPPING BOWL

By JOSEPH ARONSON

**G**IVEN an ordinary 12" to 13" round wooden chopping bowl, all you need to make this novel stand in the Early American style is three 19" pieces of  $\frac{3}{8}$ " by 2" hardwood for legs and one piece about  $8\frac{1}{2}$ " by 10" for the lower plate. The result is a satisfying bit of furniture, useful in almost any room as a sewing stand, as a receptacle for fruits and nuts, or as a general catchall for the usual run of odds and ends.

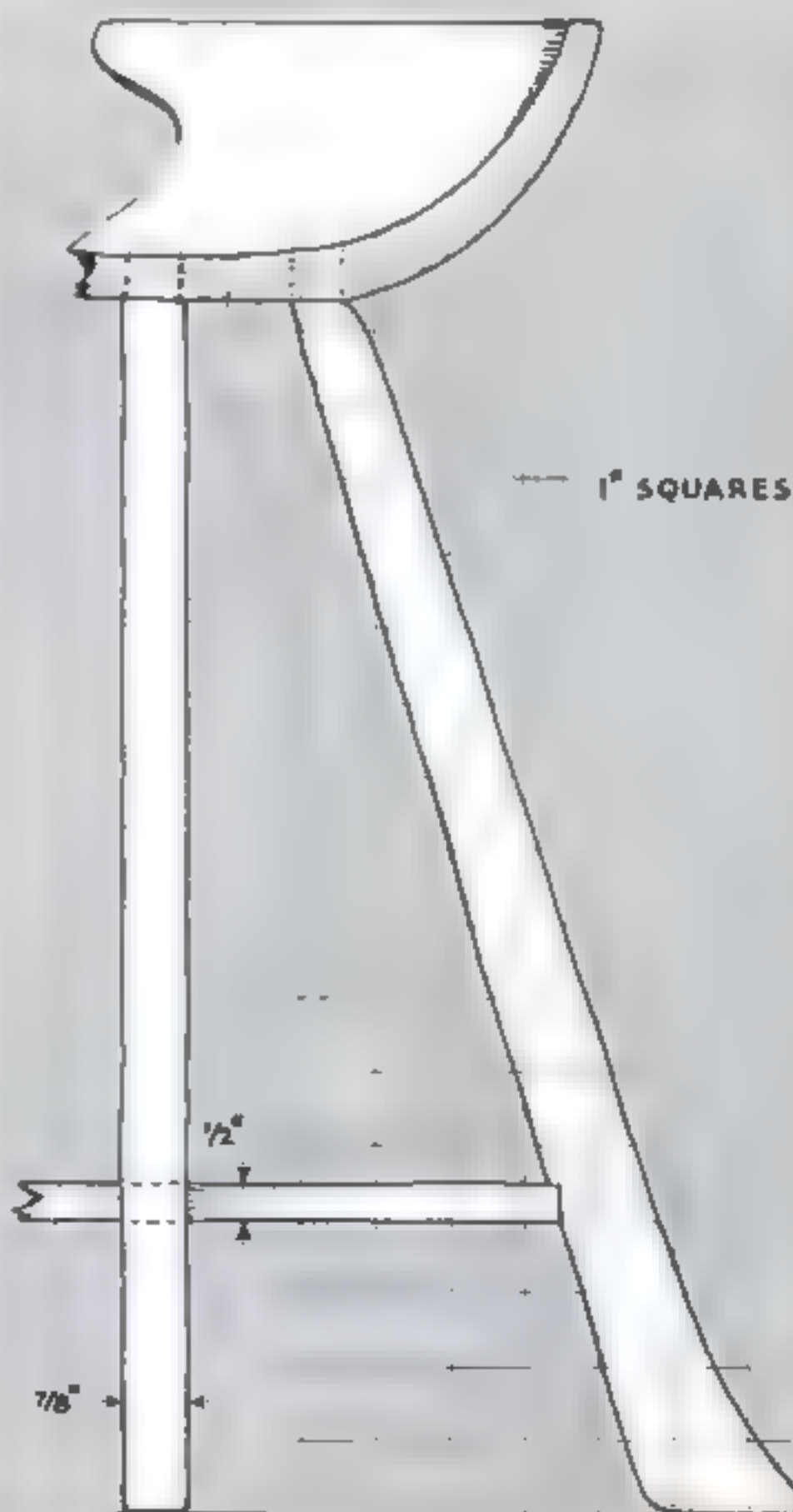
Saw out the legs to the profile shown in the drawing and round all edges fully as indicated in the photograph on the facing page. Note particularly that the end of the leg that dovetails into the bowl is not a continuation of the rake of the leg, but is a true vertical. This makes it easier to locate the holes in the bowl. Saw the peg ends of the legs square and reduce the corners with a rasp until the pegs have been made as round as possible. Be sure to gauge carefully and frequently to the  $\frac{3}{8}$ " bit you will use for boring or, better yet, bore a  $\frac{3}{8}$ " hole in a trial block and use this as a gauge as you proceed with the rasping.

Make a paper pattern for the lower plate, drawing a circle with an 11" radius and locating three equidistant points on the circumference from each of which an arc is drawn at a radius of  $9\frac{1}{8}$ ". Saw the plate section out of the  $8\frac{1}{2}$ " by 10" hardwood stock and notch it into the legs about 4" up from the feet; then secure each joint with a dowel and glue.

Locate the holes in the bowl by setting it on the frame and marking them, and bore vertically from the bottom. Press the pegs in as far as they will go, sanding them off smoothly on the inside. If you have any doubts about the snugness of the fit, small hardwood wedges

$\frac{1}{8}$ " thick and  $\frac{1}{2}$ " long can be driven in across the grain to take up any looseness in the joint.

In finishing it will be necessary first to remove the wax that is usually found on these bowls by using benzine or naphtha, but be careful of fire. Then darken the wood to your taste with oak or walnut stain, apply a thin coat of shellac, and sand and wax to the desired smoothness.







# Novel Wall

By WALTER E. BURTON

**N**ICE balance of proportion combined with practical utility is incorporated in this novel wall cabinet having three hinge-like, swinging drawers. Except for a few brads and screws, the entire cabinet is made of wood. The three drawers pivot around a wooden pin made of a  $\frac{1}{2}$ " maple dowel. When closed, the drawers nest in a housing of  $\frac{1}{4}$ " stock, and the front, back, and the left side of each drawer are also made of  $\frac{1}{4}$ " material. The right-hand side of each drawer is closed by the blocks that form the hinge mechanism.

The three-drawer assembly is built as one unit and then sawed into sections to form the individual drawers, thus assuring uni-

formity of size and fit. Enough white pine blocks of any convenient thickness to add up to a little more than 6" are rough cut to shape as shown in the drawing, and  $\frac{1}{8}$ " holes are bored through their centers to receive the hinge pin. Align the blocks on a length of  $\frac{1}{2}$ " dowel, applying a thin coat of glue to both facing surfaces as they are put on, clamp them firmly, and then remove the dowel. When the glue has set, smooth and square up the piece and cut rabbets to receive the front and back panels of the drawer unit.

Assemble the front, back, side, and hinge block with brads and glue to form a hollow rectangle which is then bandsawed into three equal parts. Be careful not to place brads where the saw will meet them. Next glue the  $\frac{1}{4}$ " bottoms inside the drawers, thus completing those units.

The top and bottom pieces of the housing unit have the same shape as a horizontal section of a drawer except that each is made  $\frac{1}{4}$ " wider in order to accommodate the back piece of  $\frac{1}{4}$ " plywood, which has three countersunk screw holes in it for fastening the cabinet to the wall. Glue and screw a 1" disk to the top end of the  $\frac{1}{2}$ " maple dowel upon which the drawers swing. The bottom end has a  $\frac{1}{4}$ " disk held by a screw that can be tightened or loosened to regulate the friction between drawers, which should swing easily yet remain in whatever position they are left. A latch or other fastening device is not needed.

Give the cabinet a finish to harmonize with its surroundings. The one in the photo has a black-enameled top and bottom, buff drawer fronts, and a Chinese red interior.

A dowel and a piece of waste stock form a jig that allows of sending all the drawer blocks to precisely the same curvature

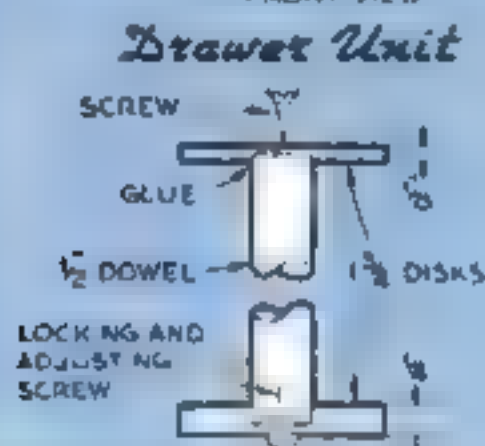
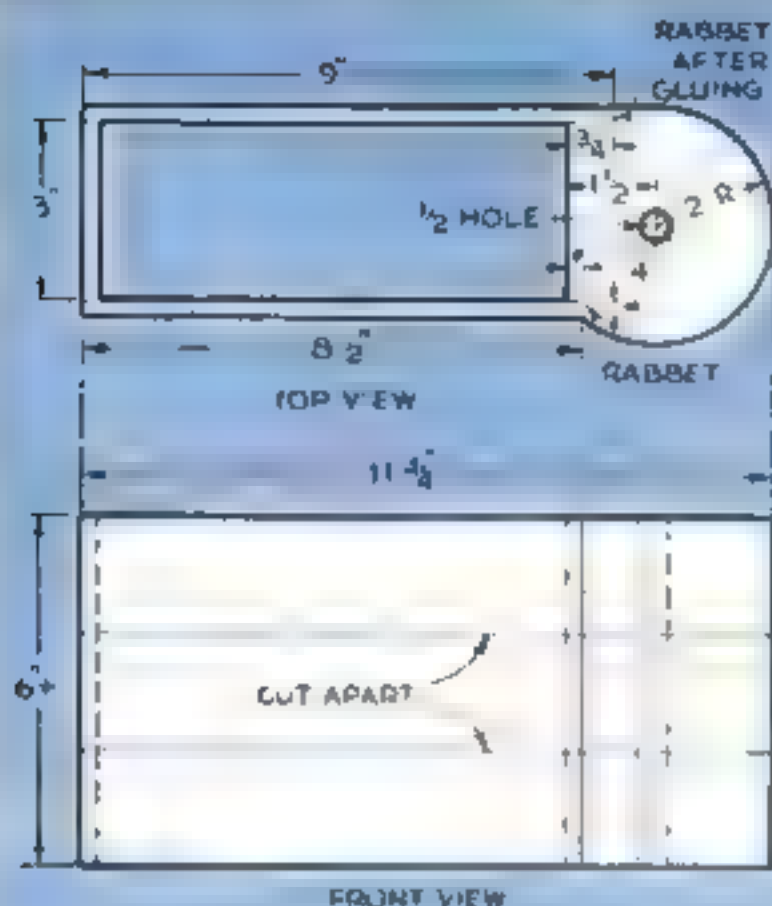
When gluing the blocks into a single hinge unit, stack them on a  $\frac{1}{2}$ " dowel for alignment. The dowel is taken out after the blocks are securely clamped



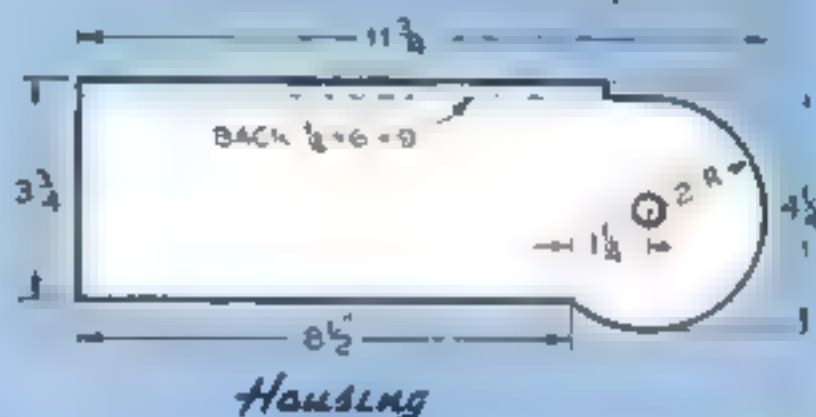


# Cabinet

## HAS SWINGING DRAWERS



Front and back panels for drawers are glued and bradded into rabbets in the hinge block. This whole assembly is then sawed into three compartments

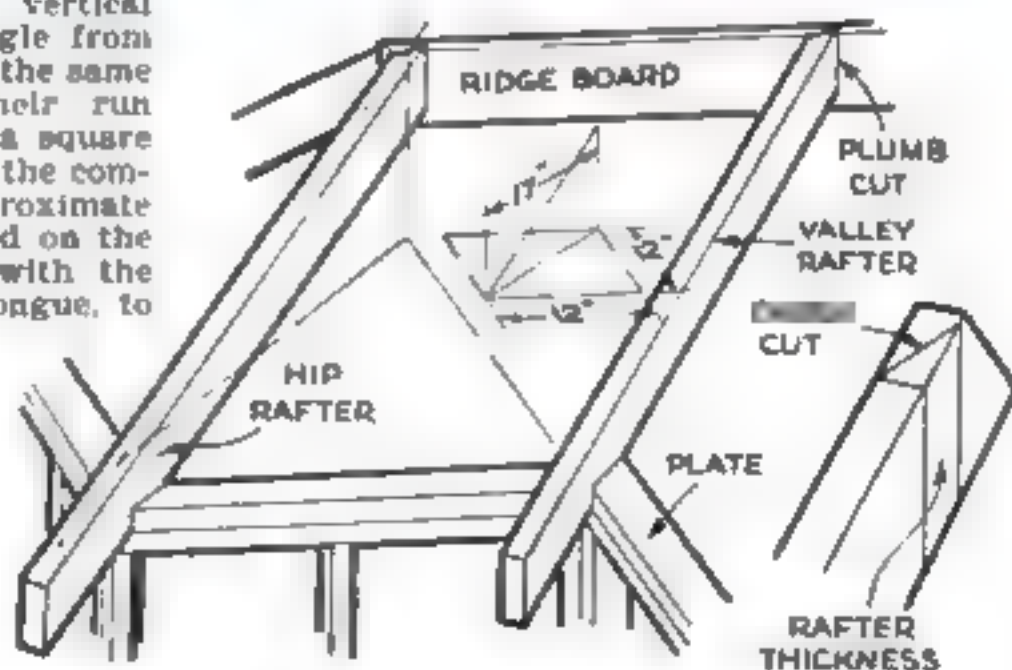


## HIP AND VALLEY RAFTERS

[ SHIPSHAPE HOME ]

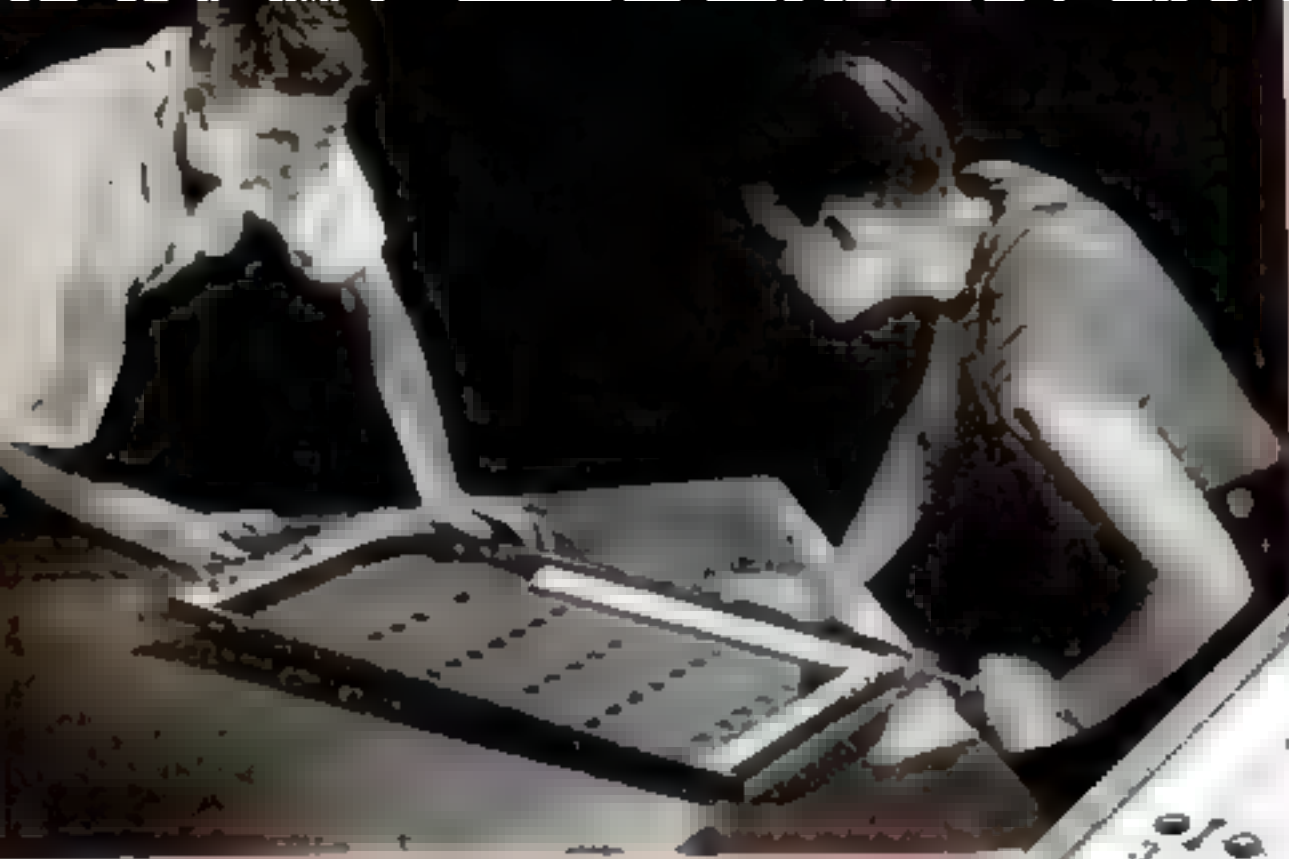
Hip and valley rafters lie in vertical planes that are at a 45-deg. angle from the walls, and while they rise to the same height as common rafters, their run (horizontal) is the diagonal of a square having sides equal to the run of the common rafters. Thus 17" (the approximate diagonal of a 12" square) is used on the blade of a steel square, along with the rise in inches per foot on the tongue, to mark off the angle of the plumb cut and that of the heel cut in the notch.

For the cheek cut fitting against the ridge board draw a line parallel to the plumb cut at a distance equal to the thickness of the rafter, square across the crown, and draw the diagonal, as shown.

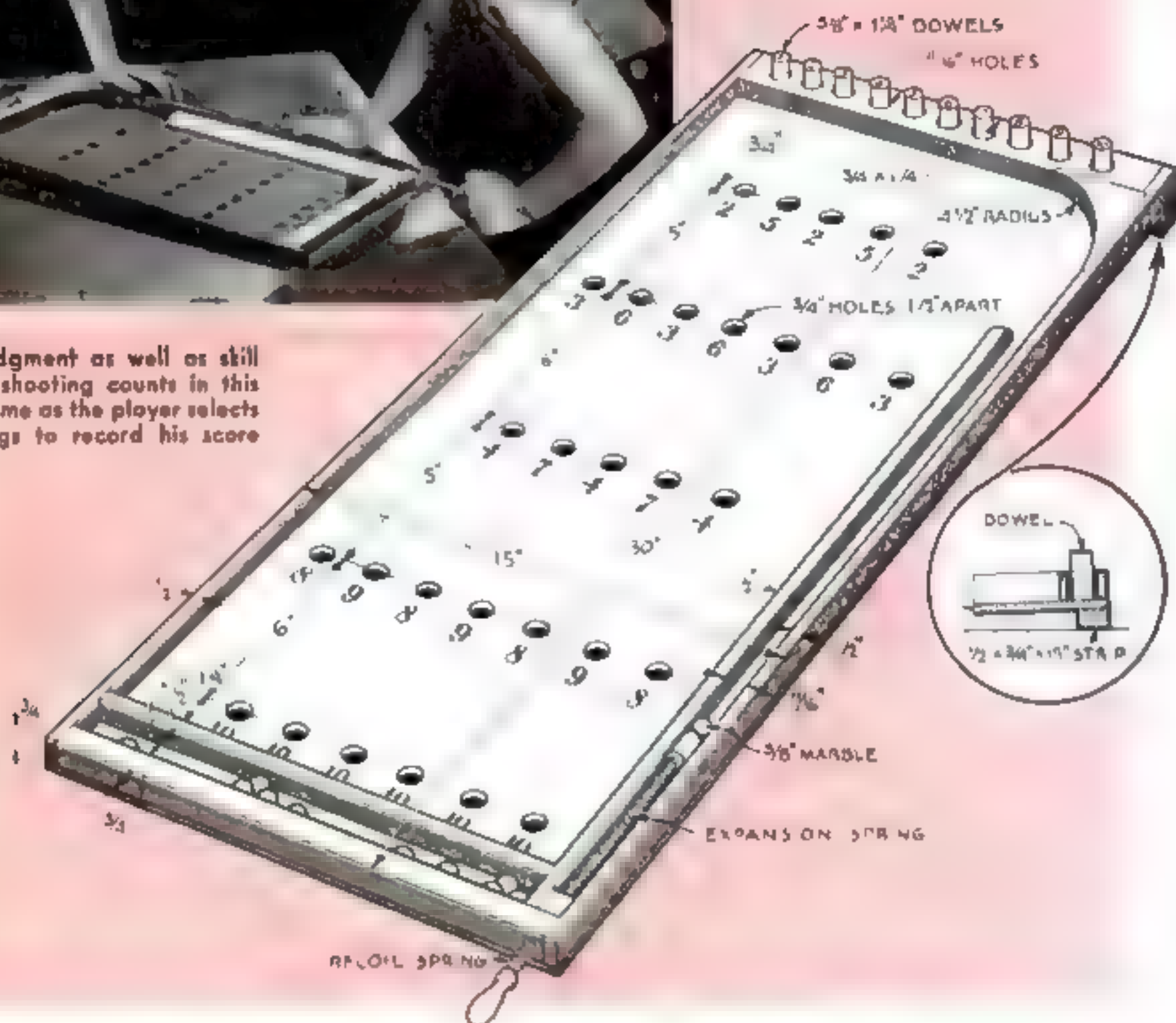


POPULAR SCIENCE MONTHLY SHOP DATA





Judgment as well as skill in shooting counts in this game as the player selects pegs to record his score



## Pinball Game Scored in Reverse

By MYRON FLEISHMAN

**L**OW score wins in this pinball game with an upside-down scoring arrangement. The trick is to shoot marbles around the game board so that they fall into the high-numbered holes, whereupon correspondingly numbered dowels are turned upside down in a row of holes provided for them at one end of the board. At the conclusion of ten shots, a player adds up the value of his dowels still remaining upright. A low total indicates, of course, that good marksmanship guided the marbles to the more valuable holes.

The board is constructed mostly of  $\frac{1}{2}$ " by  $\frac{3}{4}$ " wooden strips and of cardboard. Cut the ten dowels from  $\frac{3}{8}$ " stock, and use ten

$\frac{3}{8}$ " marbles. The holes in the cardboard can be punched with the end of a piece of pipe ground down to a cutting edge.

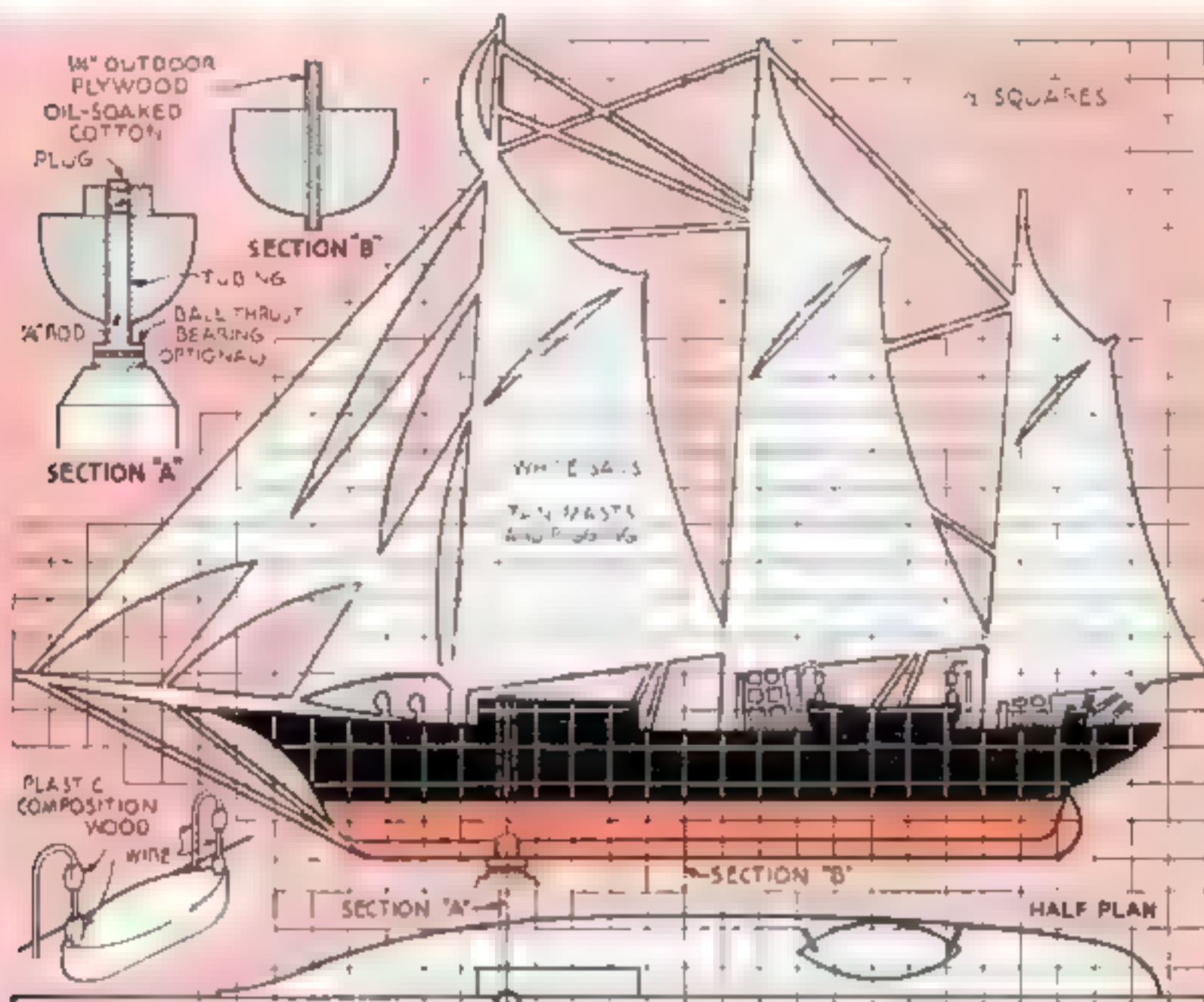
Before a player takes his turn at the shooting ram, the ten dowels are arranged in numerical order in their holes. Then a marble is shot with enough speed to make it rebound among the scoring holes. If it falls into a No. 5 hole, for example, either the No. 5 dowel is turned upside down, or the same is done with any combination of dowels the value of which equals 5, and so on for the ten shots. But if a player hits a hole for which no dowel or combination is still available, he forfeits the remainder of his shots. Thus a premium is placed upon the player's shrewdness in turning down dowels.



## Built-Up Hull Adds Realism to Rakish Schooner Weather Vane

MORE than a mere silhouette is this weather vane in the form of a rakish schooner, for a three-dimensional effect is achieved by the two quarter-round pieces which form the hull, the deckhouse, and the lifeboats with davits. The central section of  $\frac{1}{4}$ " outdoor plywood includes sails, rigging, and the portion of the hull clamped between the cheek-

pieces. It is pivoted on a bar set in a section of tubing, and the ball-and-thrust bearing, if kept lubricated with oil-soaked cotton, will enable the ship to head into any breeze, however light. Paint the hull black above the water line and red below, the sails white, rigging and deckhouse brown, and the lifeboats white.—HI SIBLEY.

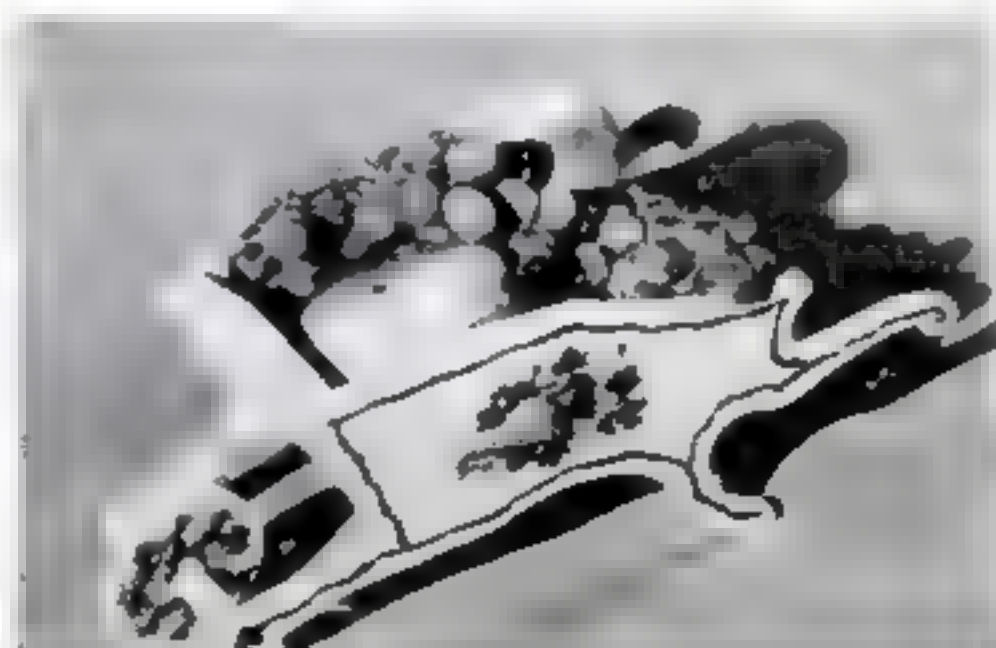
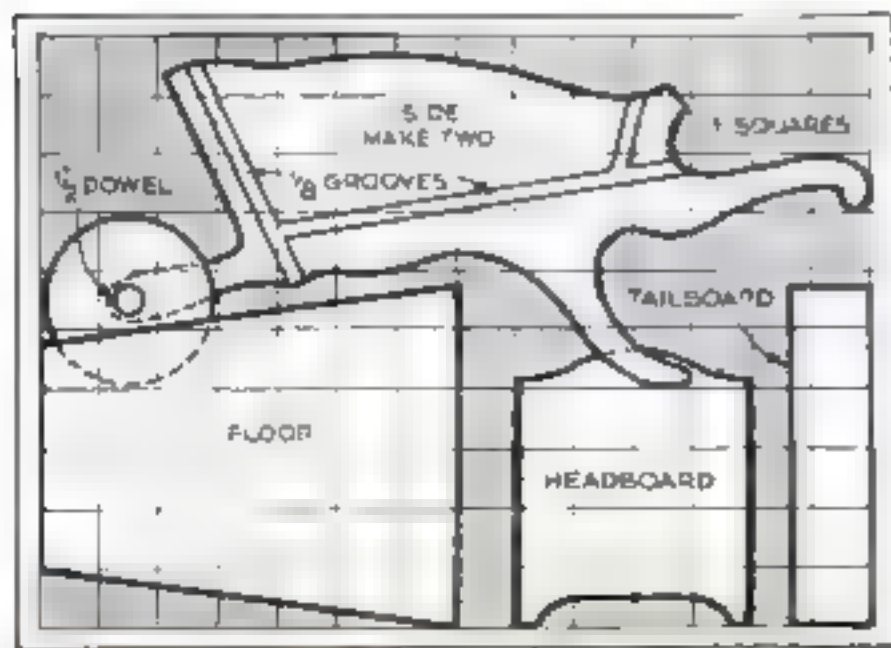


## Wheelbarrow with Brilliant Finish Is Attractive Table Piece

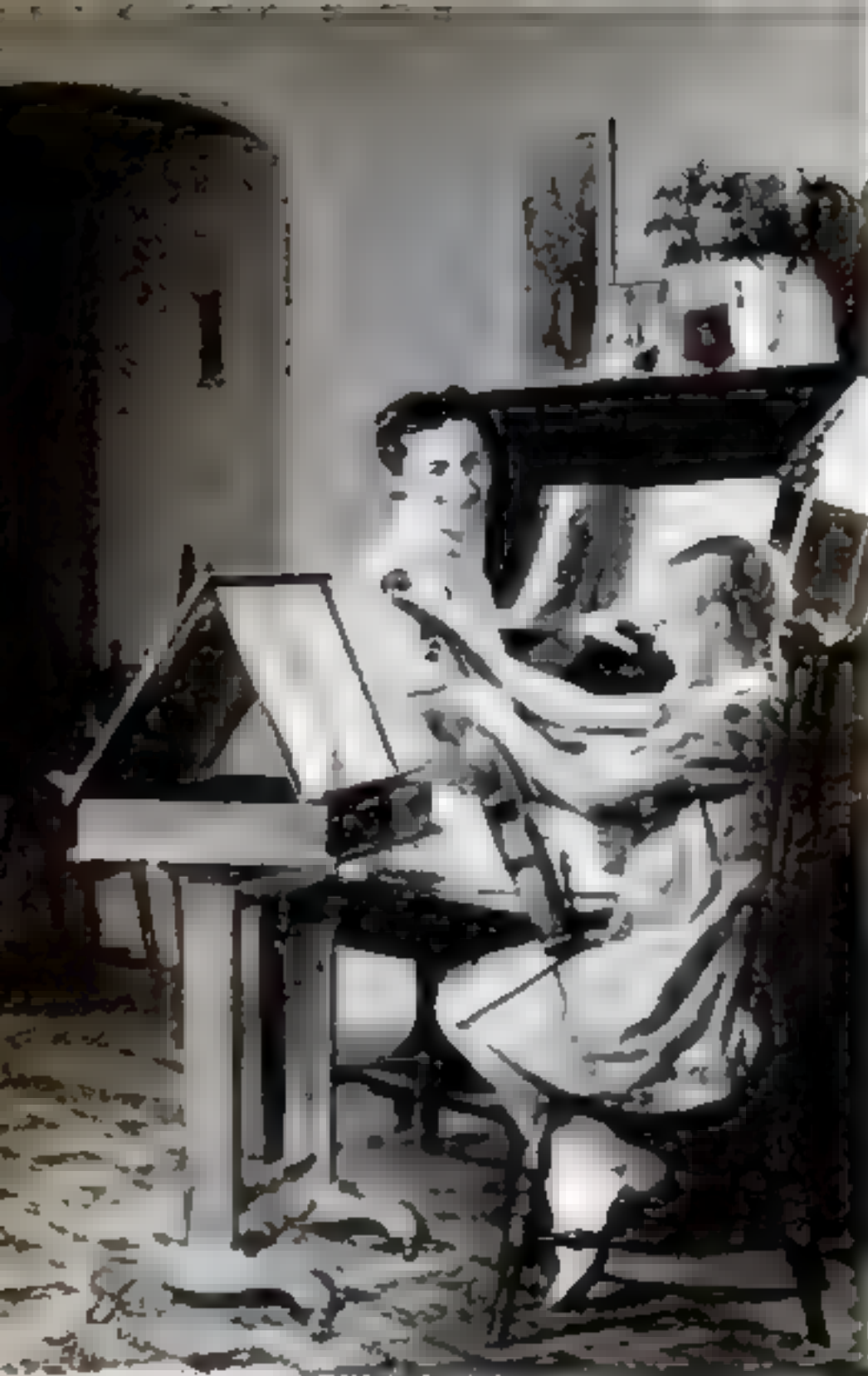
THIS glossy white wheelbarrow is handsome enough to serve as the centerpiece of a formal table setting. Three-ply basswood will take an excellent finish, but any soft wood will do if sanded carefully. In dadoing the sides to receive the floor, note that the grooves are halted at the headboard.

Glue the parts together, sand to a satin

smoothness, and apply two coats of flat white paint, followed by a coat of white enamel. Allow 24 hours between each coat and sand with 0000 sandpaper before applying the next. Intertwining red and green lines hand painted around the edges will produce a rope effect. The other designs are put on with decals.—WILLIAM FREEMAN.







# Dual-purpose.

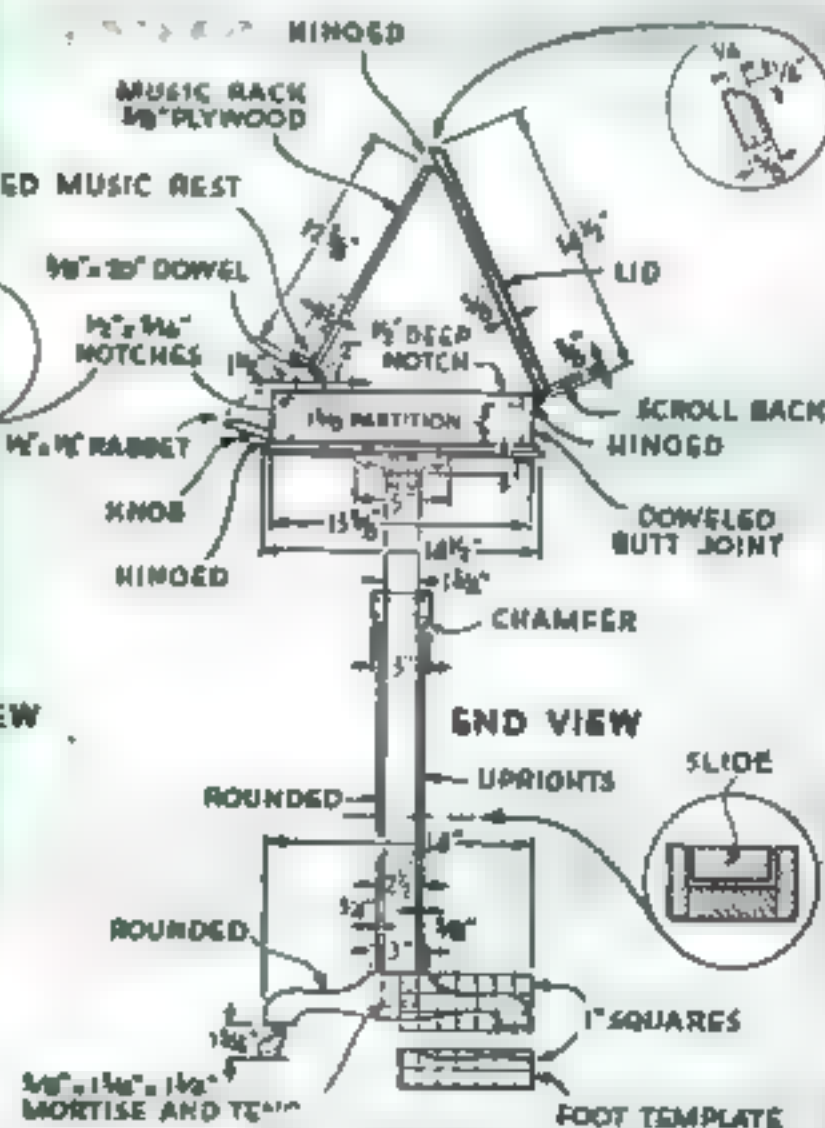
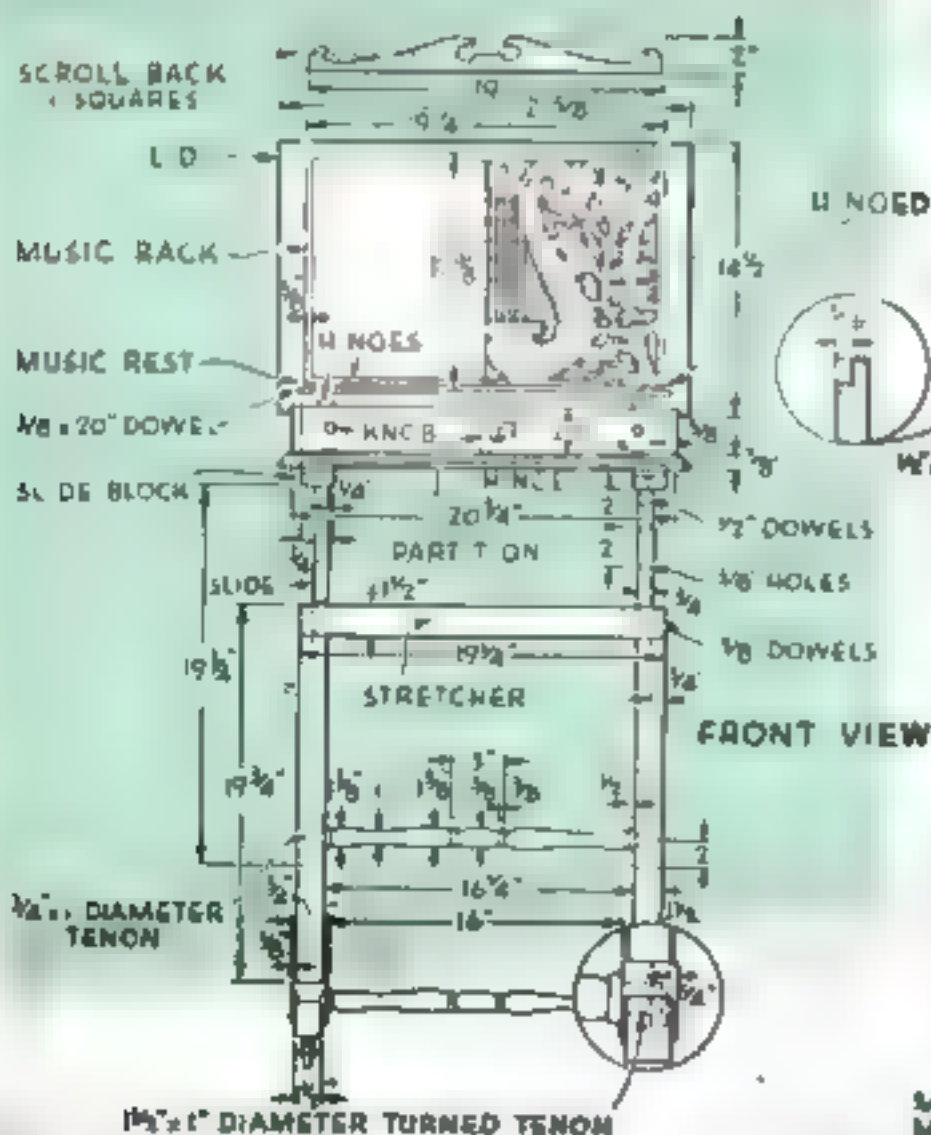
By FRANK HEGEMEYER

**O**F INTEREST to craftsmen and musicians alike, this period music stand fills a need for a rack that is readily adjustable in height and at the same time provides storage space for sheet music. When not used for music, the stand becomes an attractive side table. The design was adapted from a stand made in 1835.

Space is provided in the generous-size music compartment for some 200 copies of standard 9" by 12" sheet music. A hinged false drawer front makes the music easily accessible. A music rack, which has a scrolled lyre-and-leaf design or may be of plain plywood, is hinged to the lid and folds inside the music compartment when the lid is closed.

The rack can be raised to three different angles by the use of a dowel secured with brads to the bottom of the rack. This dowel rests in notches along the sides of the compartment. The lid, with its broken-pediment back rail, provides an additional rack to hold music so that two persons, one on each side of the stand, can use it simultaneously.

Adjustment of the height of the rack is accomplished by the use of two 3" pins cut





# Music Stand

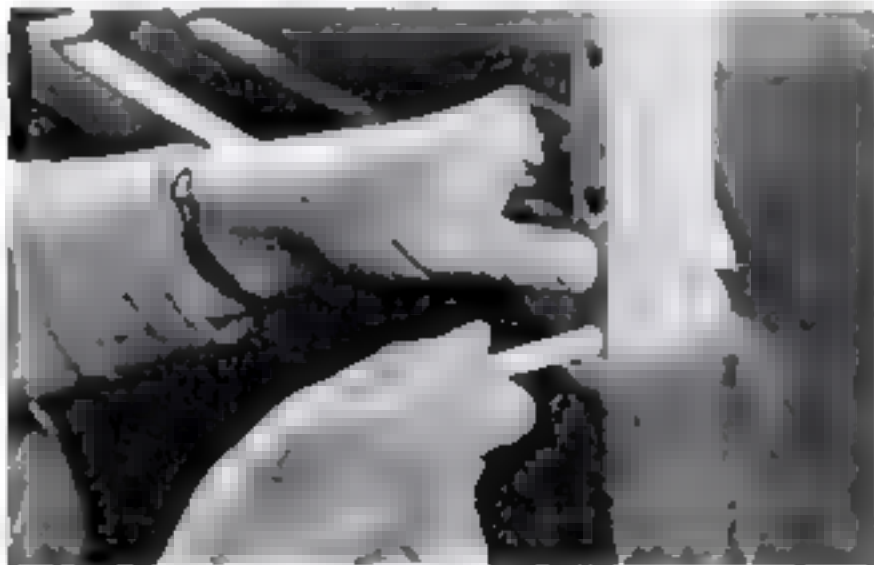
SERVES AS  
OCCASIONAL TABLE  
WHEN CLOSED

from a dowel. These are inserted in the holes bored in the slides and they rest on the two upper stretchers of the base. A series of eight holes is bored in each slide permitting a height adjustment of the rack from 34" to 50".

Wood that will take a finish that harmonizes with your piano is suitable for the stand. It is advisable to sand the various parts of the piece as each is made, because they will be hard to get at after assembling.

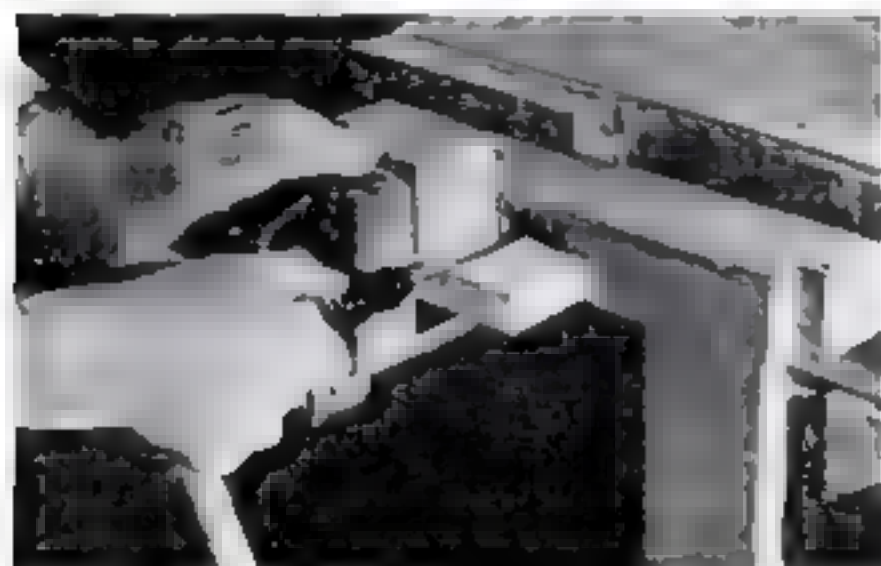
Blocks for the feet are glued up of three layers of 1" stock. Cut the mortise in the feet for the upright tenon  $\frac{1}{4}$ " from the outside edge and bore the holes for the casters. Bandsaw the arch and instep. A cardboard template, cut as shown in the drawing, is then used in scribing the lines for the side cuts, with the smaller end of the template set at the end of a foot.

Channels are formed on the uprights for the slides by gluing strips to the uprights. Cut  $\frac{1}{2}$ " away from the outside edge of the lower ends of the uprights to leave a tenon  $\frac{5}{8}$ " thick. Round the edges of the uprights and feet before assembling. Bore the holes in the feet for the turned stretcher tenons. Note that the tenons of the uprights are



Holes for dowels in the sliding uprights permit eight 2" adjustments in the height of the rack

Small blocks nailed together form an L to guide the chisel when the mortises are cut in the feet



A cardboard template is aligned with one side of the foot when lines on the other side are scribed

It is essential to nail a brace across the arch of a foot when sawing the contour of the sides







Glue in the lower stretcher before fitting the legs to the two stretchers at the top



Clamp the sides together and bore  $\frac{5}{8}$ " holes  $\frac{1}{2}$ " deep at the joint for aligned rack stops

anchored in the feet by these turned tenons. Fit the slide assembly to slip freely in the channels before connecting it to the bottom of the music compartment. The two turned stretchers are identical in shape except for their lengths which vary  $1\frac{1}{4}$ ".

Shape the edges of the lid and bottom of the music compartment as shown in the drawing. It is advisable to glue up the stock for the lid of  $\frac{3}{4}$ " lumber with the heart and sap sides alternating to minimize warping, then dress it down to  $\frac{5}{8}$ ". Notches for adjusting the angle of the rack are made by clamping the sidepieces face to face and boring  $\frac{5}{8}$ " vertical holes  $\frac{1}{2}$ " deep in the joint between them. The notches thus formed are correctly aligned for receiving the propped-up rack. The ends of the music compartment are jointed to the back with doweled butt joints, and the back rail is doweled to the lid.

Make a cardboard cutout design of the music rack and mark the pattern on plywood. Flatten on one side a dowel long enough to reach between the notched sides of the music compartment, and brad it to the bottom of the rack.

After a trial fit, assemble the stand with a good grade of glue. Apply a filler to open-grained wood, wiping it off across the grain. Sand lightly and then finish the stand with varnish or lacquer.

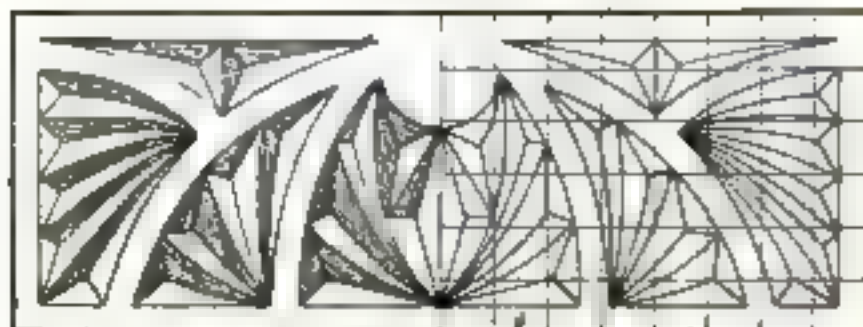
### LIST OF MATERIALS

No.	Pa.	Description	T	W	L
2		Foot blocks	12 $\frac{1}{2}$	2 $\frac{1}{2}$	14
2		Upright center pieces	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19 $\frac{1}{2}$
4		a rips	12 $\frac{1}{2}$	1 $\frac{1}{2}$	18 $\frac{1}{2}$
2		Top stretchers	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19 $\frac{1}{2}$
1		Foot stretcher	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19
1		Slide	12 $\frac{1}{2}$	1 $\frac{1}{2}$	17 $\frac{1}{2}$
2		Slide blocks	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19 $\frac{1}{2}$
1		Compartment bottom	12 $\frac{1}{2}$	1 $\frac{1}{2}$	5
2		" " " " " "	12 $\frac{1}{2}$	1 $\frac{1}{2}$	21 $\frac{1}{2}$
1		" " " " " "	12 $\frac{1}{2}$	1 $\frac{1}{2}$	13 $\frac{1}{2}$
1		" " " " " "	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19 $\frac{1}{2}$
1		False drawer front	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19 $\frac{1}{2}$
1		Partition	12 $\frac{1}{2}$	1 $\frac{1}{2}$	12
1		Lid	12 $\frac{1}{2}$	1 $\frac{1}{2}$	21 $\frac{1}{2}$
1		Back rail	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19
1		Music rack (plywood)	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19 $\frac{1}{2}$
1		rest	12 $\frac{1}{2}$	1 $\frac{1}{2}$	19 $\frac{1}{2}$
1		Dowel	12 $\frac{1}{2}$	1 $\frac{1}{2}$	20
2		drawer knobs, 4 1" hinges (for lid and drawer front) 4 2 $\frac{1}{2}$ " hinges (for rest and rack), 4 centers.			

Note: All dimensions are given in inches.

## Design in Gothic Manner Adorns This Chip-Carved Jewel Box

Curved geometrical motifs on the front panel of this jewel box represent one of the most effective techniques of the chip carver. Strongly Gothic in feeling, this particular design employs a modified form of the triangular patterns usually followed in such carving. As with pyramids, the curving units of this design are formed by vertical cuts made first on three inner lines, then followed by sloping cuts carried from the outer limits until they meet the vertical incisions, thus freeing the chip. Use a chip-carving knife or a skew chisel. The box is 3" by 5" by 8"; the stock is  $\frac{1}{4}$ " except for the front, which is  $\frac{3}{4}$ " thick to allow carving  $\frac{1}{4}$ " deep.—ARNOLD C. WATSON.







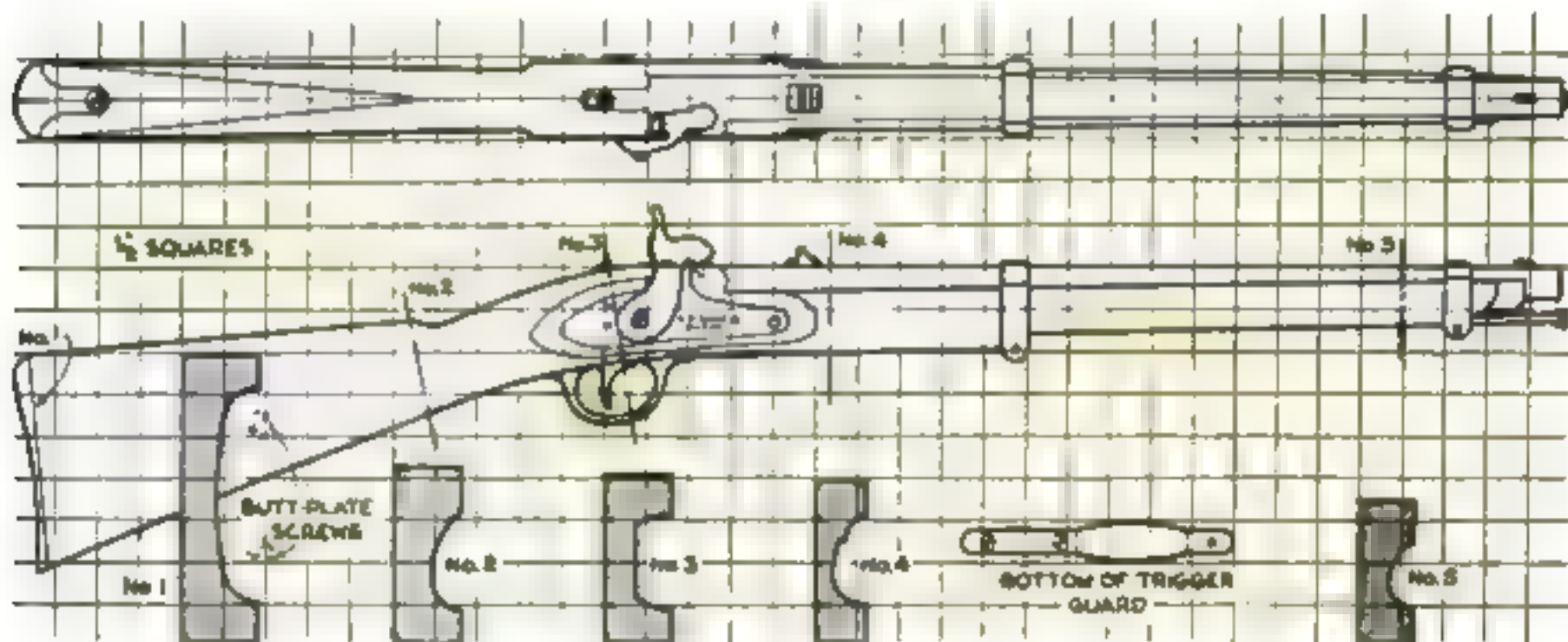
# Ball-and-Cap Gun

## MODEL OF CIVIL WAR WEAPON IS WHITTLED IN WHITE PINE

PROBABLY used during the War Between the States, the prototype of this ball-and-cap gun was made in England and is a fine-looking specimen. For a half-size model of white pine, which is easy to work, the over-all measurements should be 18 13/32" long and 3/4" thick, not including the hammer, which is made last and doweled and

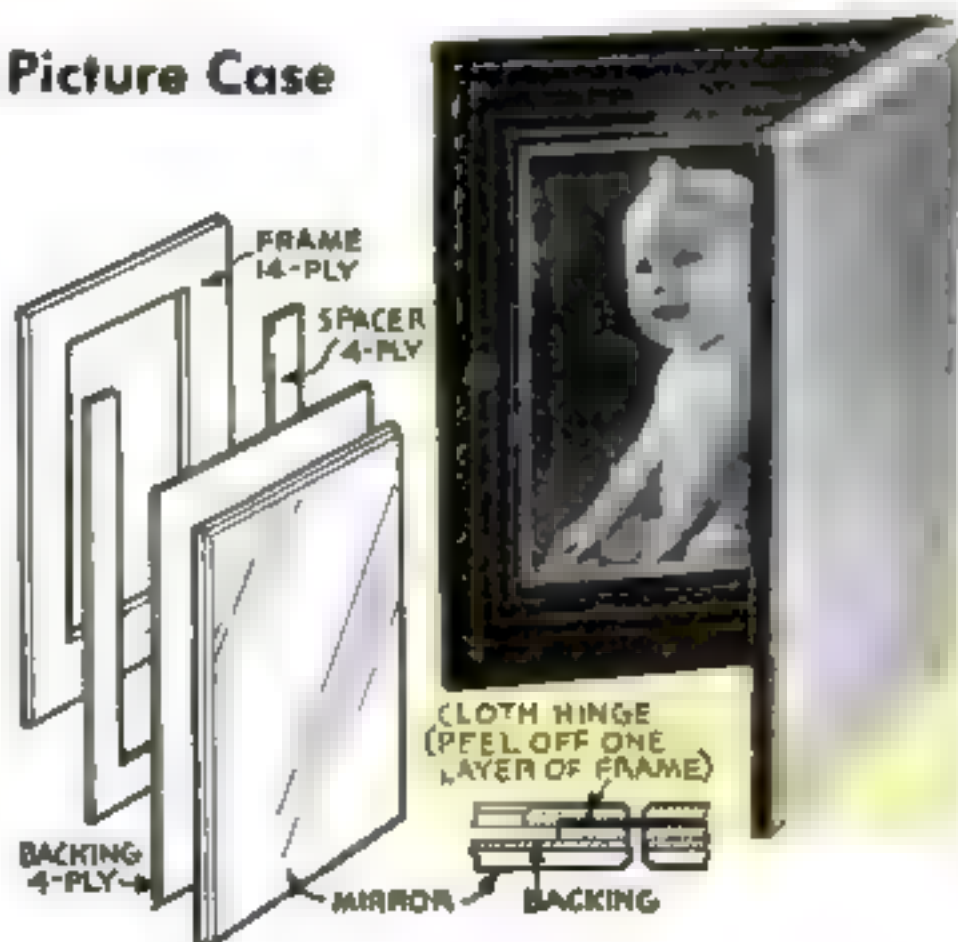
glued in place. Cut the blank on the scroll saw, cutting on the outside of the line, and sawing the trigger and inside of the trigger guard first. Draw a center line all the way around the edge of the blank to balance the whittling, and work from the center line on both sides. Shape the trigger and guard last to avoid breakage, working against the grain.

Add the ramrod and make small V-cuts at the butt, the side plate, and the trigger-guard plate; then carefully sand the entire model smooth. The inscription of the manufacturer may be put on the right side-plate with a sharp pencil.—CARL R. ERICH.



## Mirrors Form Covers of Pocket Picture Case

DOUBLE-FACE pocket mirrors will be found suitable for making the covers of this pocket picture case. Pry the two faces of a mirror apart with a razor blade, first softening the shellac with a few drops of alcohol. Cut to size and shellac two pieces of four-ply showcard board to the backs of the mirrors. Use the same cardboard for the 1/4" marginal strips, and affix them with glue. The picture frames are made of 14-ply board. Before being cut, the cardboard is given two coats of varnish and a coat of floor wax. A decorative design can be tooled on the cardboard frame, while the two halves of a snap fastener are cemented in recesses cut in each frame.—F. S.





# SPECIAL JOINTS YOU CAN MAKE *with* HAND TOOLS

By Edwin M. Love

**W**OODWORKING joints based on the tenon and on the half lap have been devised in a variety of modifications. In general, the simpler you can make these forms, the better they will be, not only because they can be made more quickly, but also because the difficult fitting together of a number of pieces tends to weaken a joint, defeating one of the principal purposes of good design.

*Why is the double mortise and tenon widely used?*

Among the simpler joints, the double mortise and tenon is the best for many purposes, for it holds a natural advantage over the joint made with a single tenon. It replaces a very wide tenon with two narrow ones, thus permitting two mortises with stiff sides rather than one wide mortise with springy sides and also providing considerably more surface for gluing. The following routine is standard practice in the making of such joints for paneled doors.

Square the rail stock first, then lay out the tenon shoulders, squaring around the piece by pressing the stock of the try square against the face side or face edge. Mark the lines with a sharp, hard pencil or a knife. Do not score deeply with a blade because it will crush back the shoulder corners and prevent a perfect fit in the finished joint.

Since the edge of the stile is grooved to receive a panel, draw a second line to guide in cutting a tenon haunch, to close the end of this groove, as shown in one of the drawings on page 154. Gauge the thickness of the tenons on the edges and ends, working from the face side, and gauge the mortises in the stile with the same setting, assuring



*Before ripping the cheeks of a double tenon, bore a hole to gauge the base of the center division*

flush faces upon assembly. In paneled structures the thickness of a tenon is determined, of course, by the thickness of the panel.

Gauge the tenon widths from the face edge and bore a hole at the base of the center division (at the same depth as the haunch). The bottom of the lower tenon shown is flush with the groove in the rail. Never cut the slot between the tenons back entirely to the shoulder of the rail, since to do so would be to eliminate wood that matches the groove of the stile and obviously adds to the strength of the mortised joint.

In forming the tenons, rip the sides, or cheeks, before cutting the shoulders. This allows the waste to support the saw. There is also less likelihood of cutting into the tenon since the waste falls away as the shoulders are cut.

After boring the mortises, chisel them from both ends, finally trimming the ends to the line. Smoothly cut ends offer considerable bracing support and relieve the glue of much strain. Allow a little clearance



at the bottom of the mortises for surplus glue and imprisoned air. Before assembling, chamfer the tenon ends to prevent marring of the mortise sides.

The tenon should enter snugly but without bulging the mortise. Smooth contact is required for good gluing strength. If the shoulders do not fit snugly, run a backsaw or a dovetail saw into the joint.

**What is a bevel-shoulder joint?** It is a mortise and tenon in two members meeting at an acute angle. The full thickness of the tenoned piece is notched into the mating piece to one seventh the depth of the latter, as shown in a drawing. This joint is used more in heavy structural framing than in furniture, yet it can be employed to advantage in some home workshop projects.

To lay out the joint, work from the face edges and employ a bevel square for marking the angles. Saw out the notch and then

lay the severed piece upon the member to be tenoned, carefully adjusting the angle before using it as a pattern to mark the tenon shoulder. Square the front of the tenon with the edge of the mortised member, not with the slope of the notch. A well-planned tenon should fit quite snugly into the mortise.

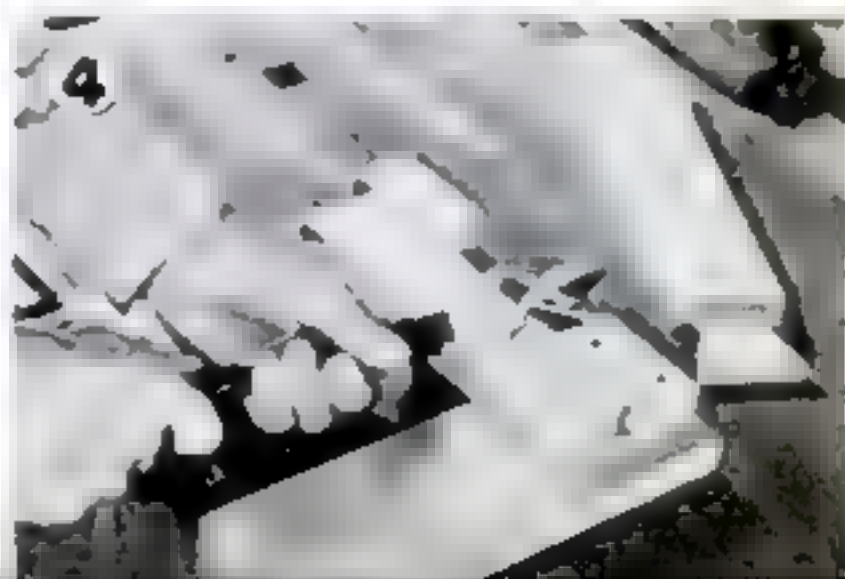
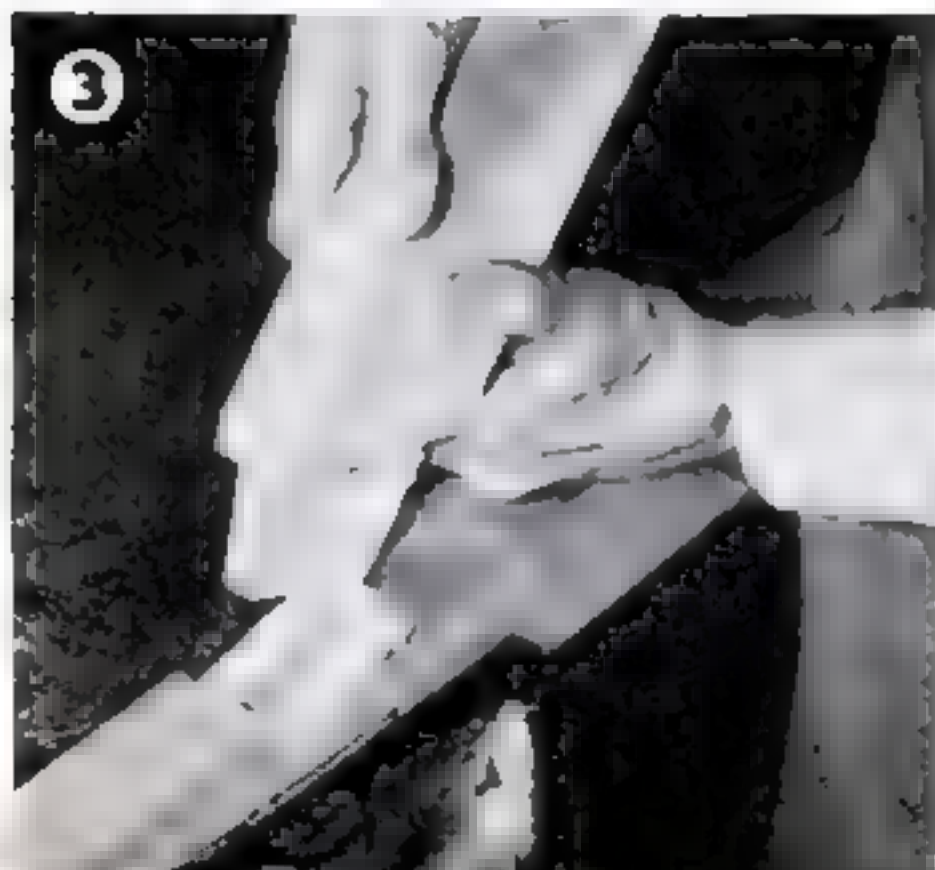
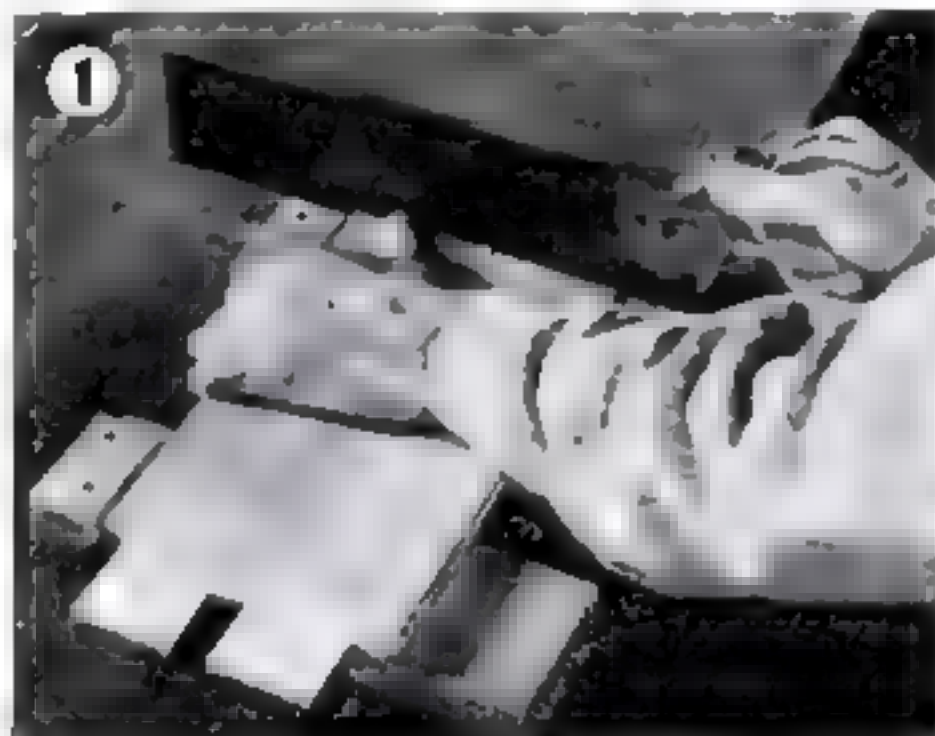
**When is a keyed mortise-and-tenon joint useful?** This joint involves a through mortise with a tenon having a slot into which a wedge is driven outside the joining member, against which it bears. The joint, though rigid, can easily be taken apart by driving out the wedge. It is useful in any structure that may, upon occasion, be dismantled, such as portable camp furniture or benches. Many variations of the joint are possible. When designing, make sure that the slot in the tenon extends well into the mortise, so the wedge when driven in will bear solidly

**1** No other saw is as good as a backsaw, often called a tenon saw, for cutting shoulders of a double tenon. Guide the saw with a thumb

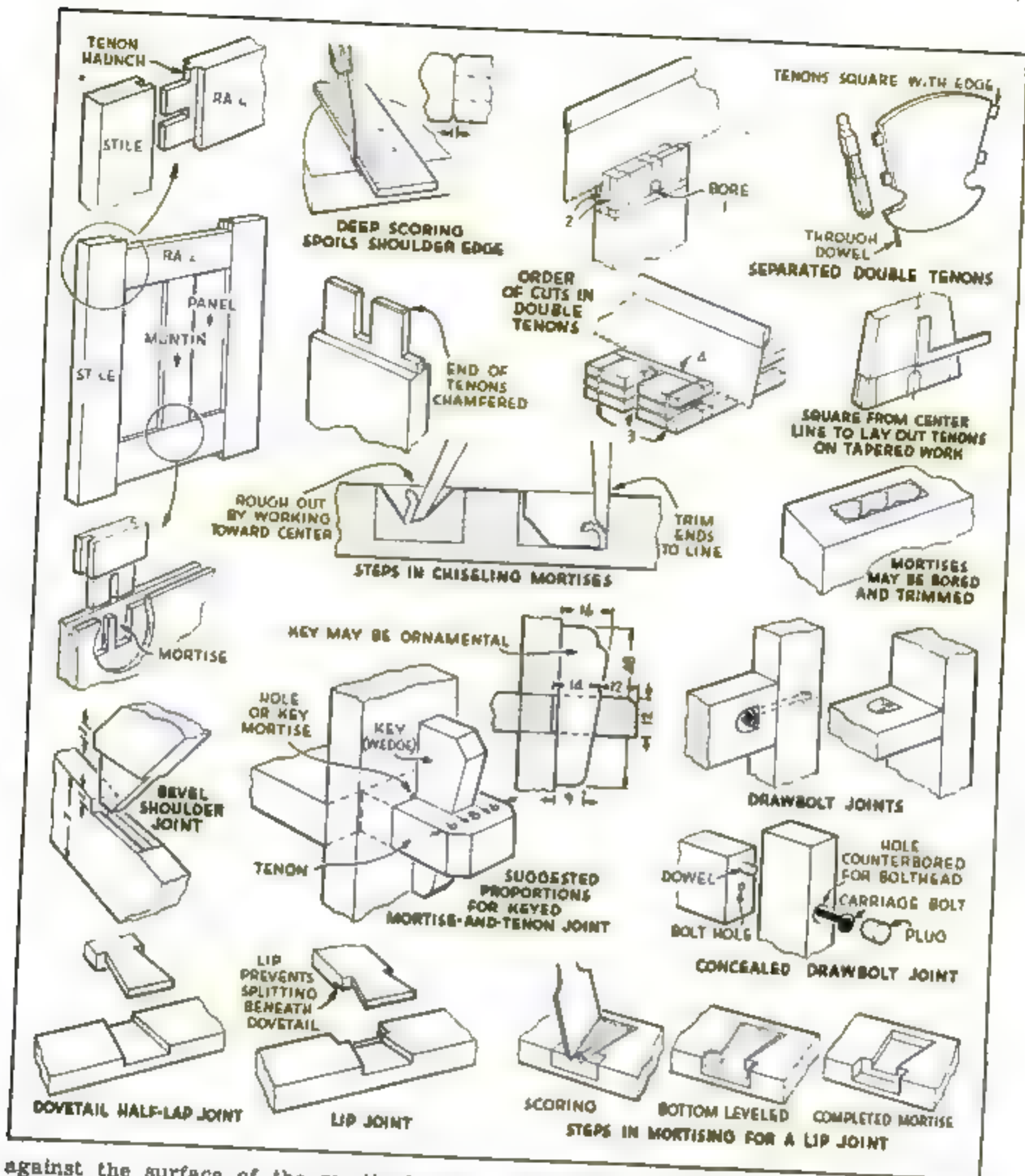
**3** A bevel-shoulder joint, in which the tenoned piece itself is notched into the mating one, gives additional strength to a mortise and tenon in structures that bear great weight

**2** Deep mortises are usually bored out before being trimmed, but shallow ones can be cut with a chisel alone. Trim the ends last

**4** When chiseling the mortise for a dovetailed half-lap joint, first score across the grain with a wide chisel, then bevel toward both edges, and finish by leveling off the bottom







against the surface of the mortised part.

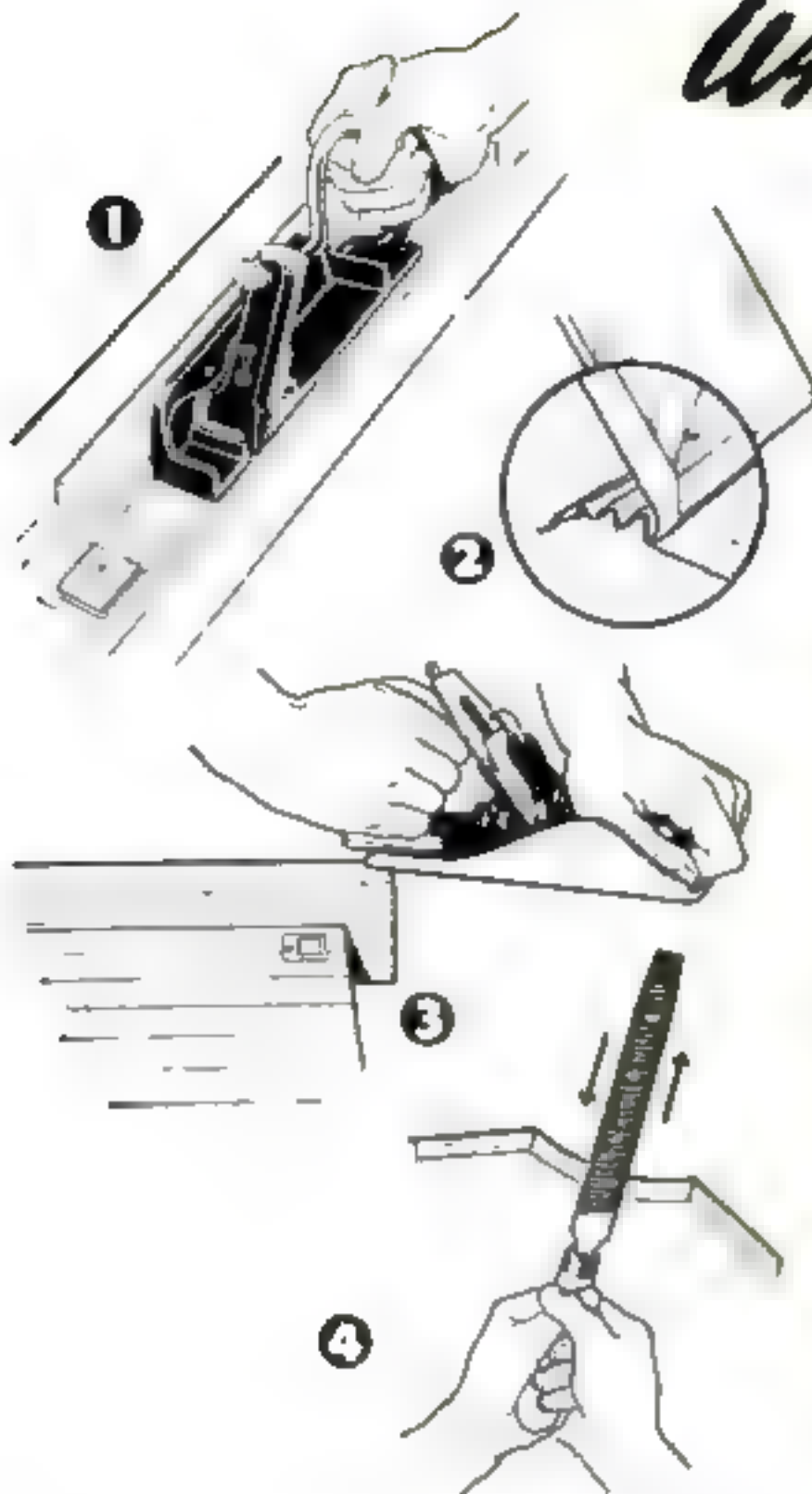
**How is a dovetail half lap made?** It is made like any half or cross-lap joint, except that the tenon is beveled back toward its shoulders to prevent it from pulling out of the mortise. In ripping the edges of the tenon, undercut them slightly to secure a wedging action when forcing the tenon into the mortise. This is a rigid joint that takes practically all of the load, the glue serving mainly to keep the tenon from lifting out.

**How is a drawbolt joint made?** When a rail is to be joined to a bench leg, gauge center lines on the sides and ends and locate the bolthole center on the leg. Square the

center line around the leg to permit boring from both sides. Bore a side hole in the rail just deep enough to permit the turning on of the nut, and chisel flat that side of the hole where the nut and washer will be seated. Assemble the joint by passing a carriage bolt through the leg and into the stretcher far enough to allow the washer to be slipped over the end. Add the nut, run it up with the fingers, and tighten it by driving the corner with a hammer and nail set. A dowel can be used in the joint to keep the rail from turning. The closed end of the hole for the nut may be turned outward or upward to hide the bolt.



# What's Wrong?



CAN you find the errors being made in the woodworking operations shown at the left? They are: (1) planing a rabbet; (2) scraping veneered work, (3) jointing a straightedge; and (4) filing a curve on a shelf. The answers appear upside down below.

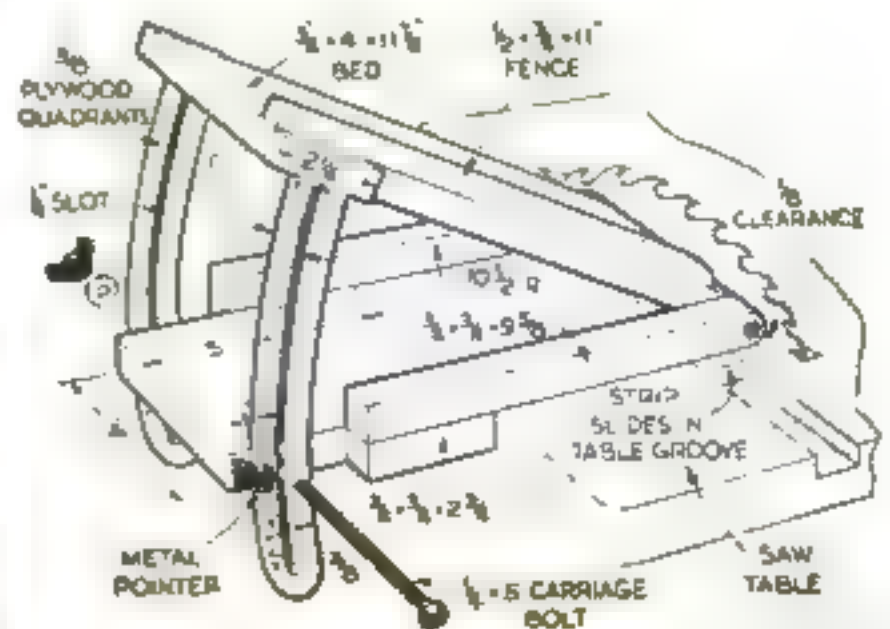
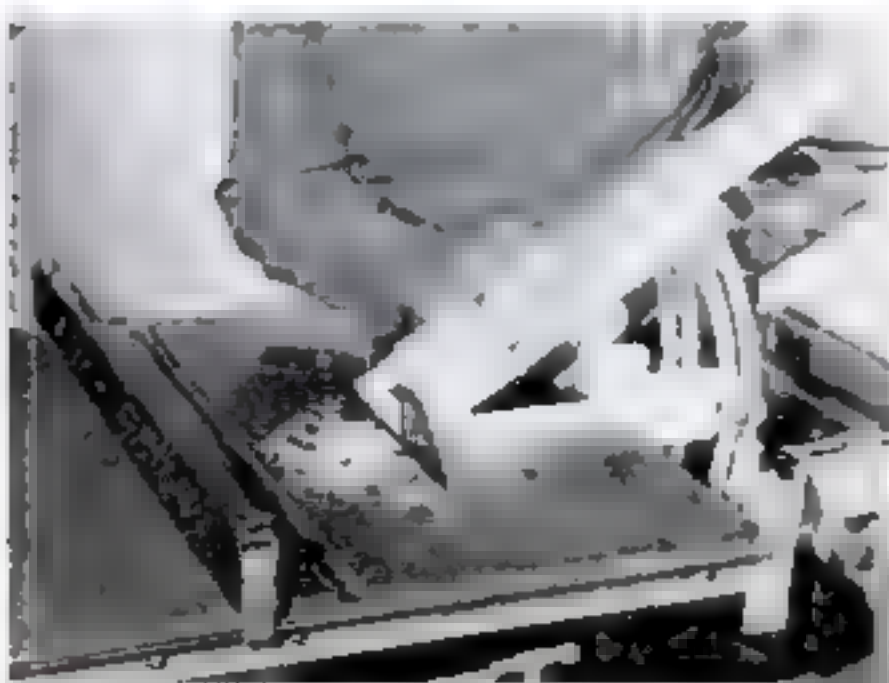
1. In cutting this rabbet, the plane itself should be guided by its fence or by a strip of wood secured to the work. 2. Chisel-edged scrapers tend to leave creases. On veneered or fine-surfaced work, use a square-edged scraper. 3. A jointer plane should be used for straightening an edge because its long sole bridges the high spots and it works them down. Every plane should be picked up at the end of a stroke to avoid dubbing off the end of the work. 4. A cabinet file is properly held with the handle in one hand and the end between the thumb and forefinger of the other. Instead of filing forward and backward in a straight line, thereby grooving the work, stroke forward and slide with a rolling motion, distributing the cut over a large section of the curve. The file should also be lifted on the return stroke, which does not cut, but only tends to dull the teeth.

## Adjustable Tilting Jig for Cutting Bevels on Circular Saw

RABBETED, locked, or splined miter joints can be cut on non-tilting circular saws with the aid of the simple jig shown in the photo and drawing below. Used with an 8" blade, the jig will permit handling stock up to 1 1/2" thick. Work up to 4" wide may be held by hand, but it is advisable to clamp a wider piece to the bed of the jig.

The dimensions given are for a jig used

on a saw with the blade 7" from the left edge of the table, and they provide for a 1/8" clearance between jig and blade. For other saws, the length of the arms and bed must be changed. Both of these pieces are rounded at the pivot end. Make the curved adjustment arms of plywood and provide a metal pointer to indicate tilt. Apply linseed oil to prevent warping.—F. H.





# S.S. Patrick Henry,

## Our First Liberty Ship

CARGO VESSEL THAT LED THE WAY IN BREAKING THE U-BOAT BLOCKADE OFFERS APPEALING SUBJECT FOR MODEL BUILDERS

By Theodore Gommi

AS APPEALING a subject for model builders as any is this first of the Liberty ships to defy the U-boat packs of the North Atlantic. The accompanying drawings follow the basic plans upon which the 10,000-ton *Patrick Henry* was built. More recent Liberty ships have been modified, but the hull lines and the general appearance of the superstructure are unchanged. And since ease and speed of construction were essential for the 441½' long prototype, details of the model were conceived in the same vein.

Only wood, paper, paint, pins, wire, and other easily obtained materials are required, and the usual household tools will suffice. Start by cutting the materials to the specified sizes and shape all flat pieces to the lines in the drawings. Plane and sandpaper the top of the hull block A to the proper sheer, and then shape the ends. The cross-section drawings and the dotted lines in the plan will be sufficient guide.

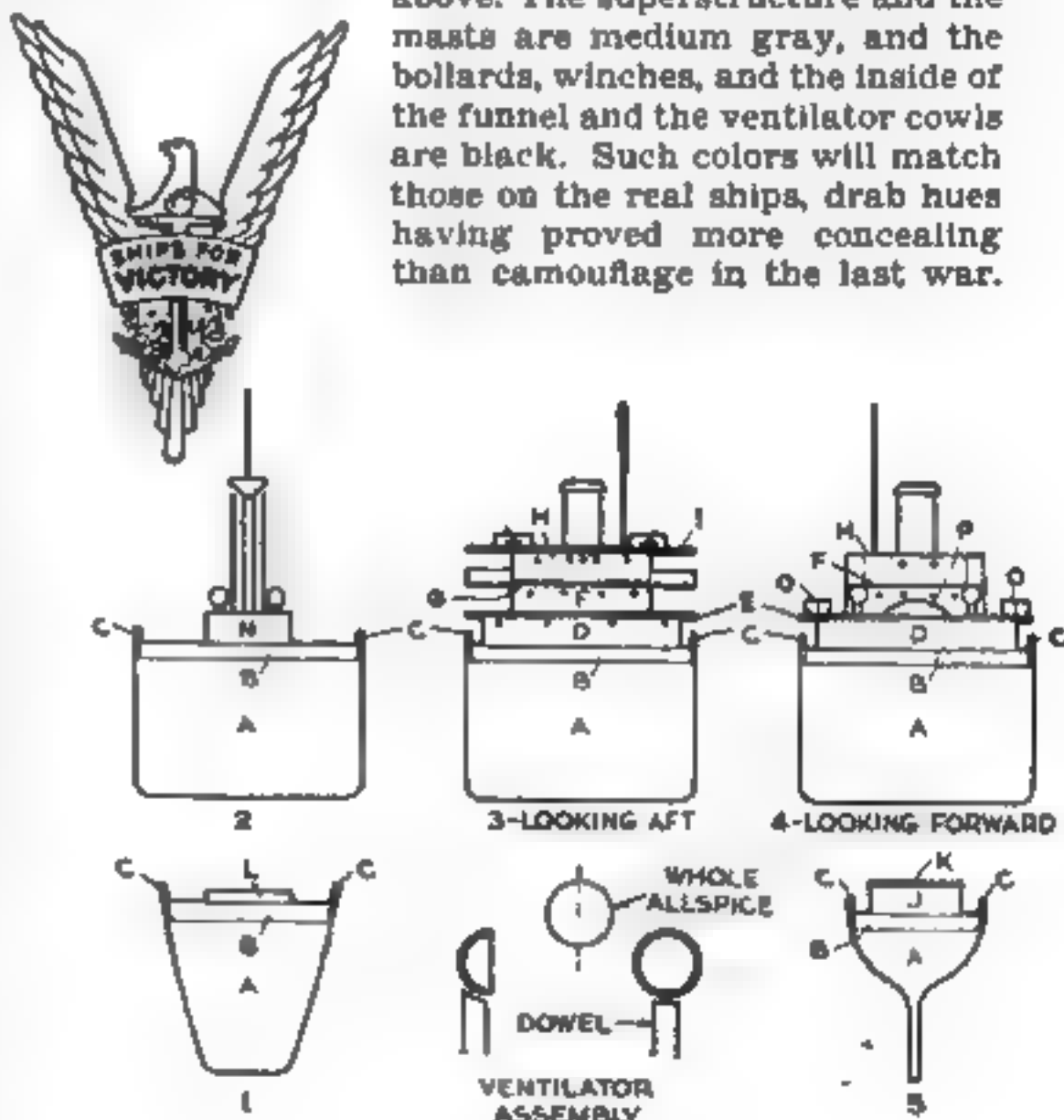
Cut B to the exact shape of the top surface of A, and reduce the width by sandpapering off 1/32" along each side to allow for the thickness of the bulwark C. Fasten B to A so that this margin is even all around, except at the very stern where B comes to the edge. Shape the bulwarks C so that they fit snugly in the rabbet formed by A and B, and shape the lower edge to match the top edge of A. Then cut the top edge parallel. The width is exactly ¼" for the entire length. Glue C to A and B. If the wood is too stiff to hold a curve, soak it in boiling water and then bend it. The perforations can then be drilled. Two or three holes are drilled in a row for the slots, and excess wood is removed.

For the superstructure, rabbet the underside of H to hold G. Port-holes are drilled in D, F, and H. Thin strips of paper protect the gun platforms and serve for bridge and stair rail. Masts are inserted into

the mast houses N, as are the wire booms, which are then bent to proper angles. Each unit is glued to the hull after it has been painted. Ventilators may be made by cutting whole allspice in half, removing the centers, and mounting the half shells on bits of tooth picks, or metal ventilators may be used.

For the bollards, glue small pieces of black paper to the deck and drive two short pieces of wire through the paper into the hull. To make a winch, slip two small eyelets over wire to form the drum and fasten it to a square of black paper. Lengths of wire are inserted through small beads for guns. The anchor and screw are heavy cardboard.

The main deck of the vessel is painted a dull red. Dark gray is used on the hull below the waterline, and a medium gray above. The superstructure and the masts are medium gray, and the bollards, winches, and the inside of the funnel and the ventilator cowls are black. Such colors will match those on the real ships, drab hues having proved more concealing than camouflage in the last war.





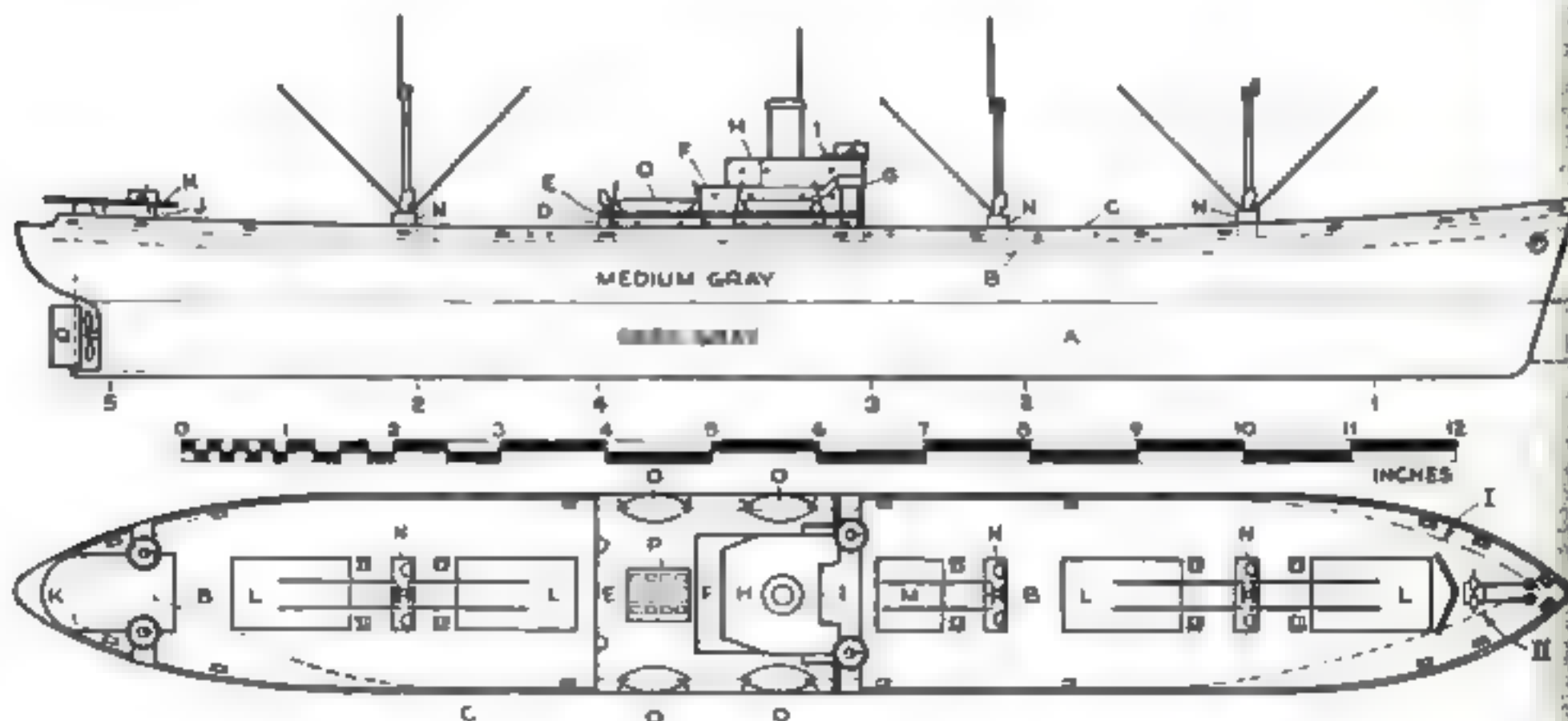


## LIST OF MATERIALS

No.	Material	T	W	L	For	No.	Material	T	W	L	For
1	Pine beam, or balsa	1 1/4	1 1/4	14 1/2	A	1	"	1 1/4	1 1/4	14 1/2	J
1	"	1 1/4	1 1/4	14 1/2	B	1	"	1 1/4	1 1/4	14 1/2	K
2	"	1 3/32	1 1/4	11 1/2	C	1	"	1 1/4	1 1/4	14 1/2	L
1	"	1 1/4	1 1/4	2 1/2	D	1	"	1 1/4	1 1/4	14 1/2	M
1	"	1 3/32	1 1/4	1 1/2	E	3	"	1 1/4	1 1/4	14 1/2	N
1	"	1 1/4	1 1/4	1 1/2	F	1	"	1 1/4	1 1/4	14 1/2	O
1	"	1 3/32	1 1/4	1 1/2	G	1	"	1 1/4	1 1/4	14 1/2	P
1	"	1 1/4	1 1/4	1 1/2	H	1	"	1 1/4	1 1/4	14 1/2	Q
1	"	1 1/4	1 1/4	1 1/2	I	1	"	1 1/4	1 1/4	14 1/2	Masts

NOTE: All dimensions are given in inches. Items marked with an asterisk need no further shaping after being cut to the dimensions given.

MISCELLANEOUS: 14 small eyelets for masts and towing line, 4 small beads for guns, 8 whole staples for ventilator rows, 1 piece of 5/16" tubing about 1/2" long for funnel, 3" thin, stiff wire for booms, beliards, davits, and guns, 2" thin chain, 1 small piece of Bristol board, 1 small piece of black paper and dark-gray, medium-gray, and dark-red paint.







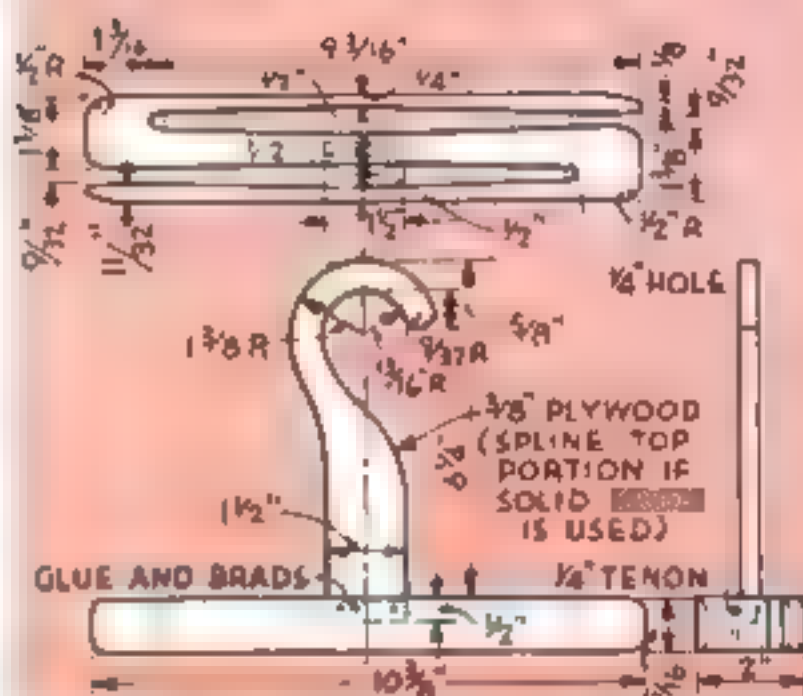
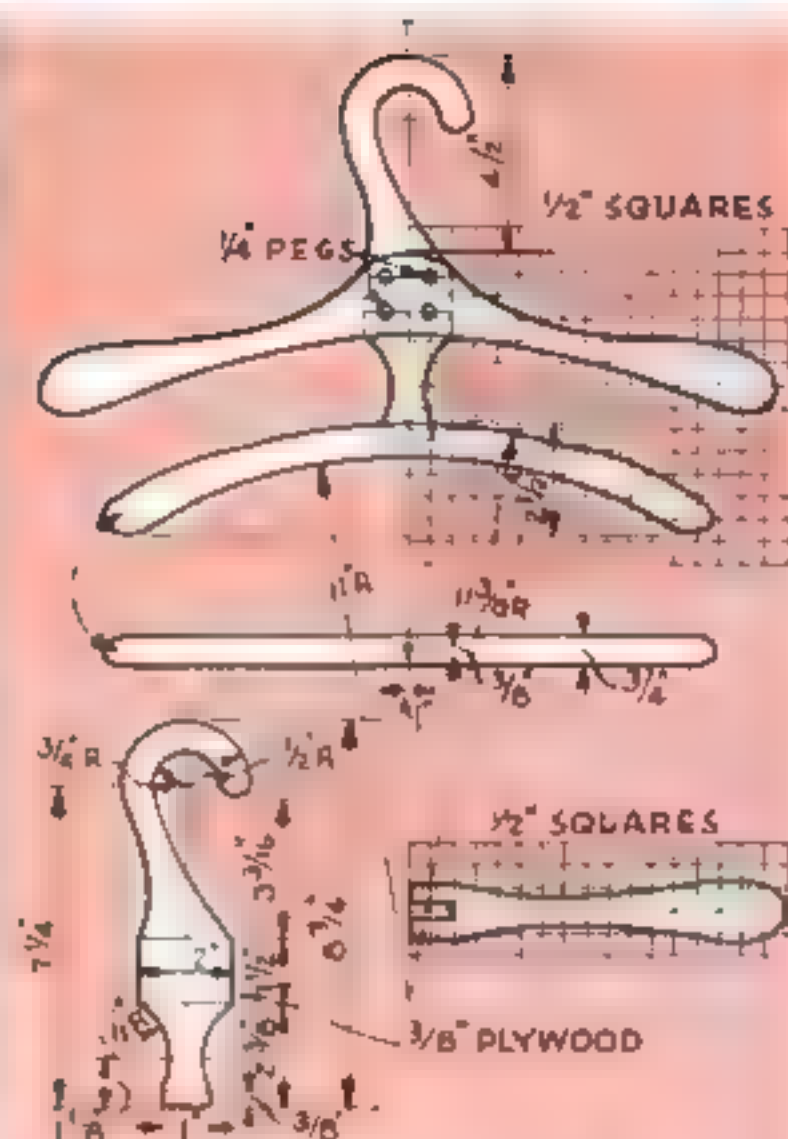
# Two-IN-ONE WARDROBE ACCESSORIES

Designed by ERNEST R. DEWALT

THESE unique clothes hangers are so sleek of line that they disguise much of the sturdy workmanship built into them. One hanger will take two coats and vests, and the other two pairs of trousers. Used by a woman, the hangers will accommodate slacks and a jacket and skirt or a dress and slip.

**DOUBLE-DECK HANGER.** Maple, birch, or cherry will make a handsome hanger, though any strong wood will do. Bandsaw the arms, following the profile drawing for the top one. It is preferable to jigsaw the hook from  $\frac{3}{8}$ " plywood, but solid wood can be used if the part is splined across the top for strength. The inside of the hook should be cut on a  $\frac{3}{4}$ " radius in order to clear a closet pole easily. Fit the halves of the top arm over the hook and drill for  $\frac{1}{4}$ " dowels. The bottom hanger may be wider near the shoulders to prevent slipping of a garment. This part is smoothed and sanded after it is bandsawed and mortised for the shank of the hook. Round all the sharp edges.

Assemble the halves of the top arm by gluing them on the hook and doweling. Glue the bottom arm in place and further secure it with a flathead screw put through a hole drilled slightly undersize and countersunk. Finish the piece with two coats of varnish thoroughly rubbed between coats. Working time, 4 hours.



**TWIN TROUSER CLIP.** Two pairs of trousers, slipped into the forks and held by the cuffs, can be hung on this rack to occupy little closet space. Cuffless trousers can be draped over the forks. To make the clip, first bandsaw the S-shaped part, adhering to the drawing for such details as the opening, the widened middle portion of the slot (where seams would make the trousers thickest), and the wall thickness for strength. Bore the holes and bandsaw this part, sanding inside walls and softening all edges. Round the ends and corners as indicated in the photo and drawing. Chisel out a mortise for a plywood hook made the same way as that for the companion piece, assemble the two parts with glue, and clinch with two brads. Working time, 3½ hours.

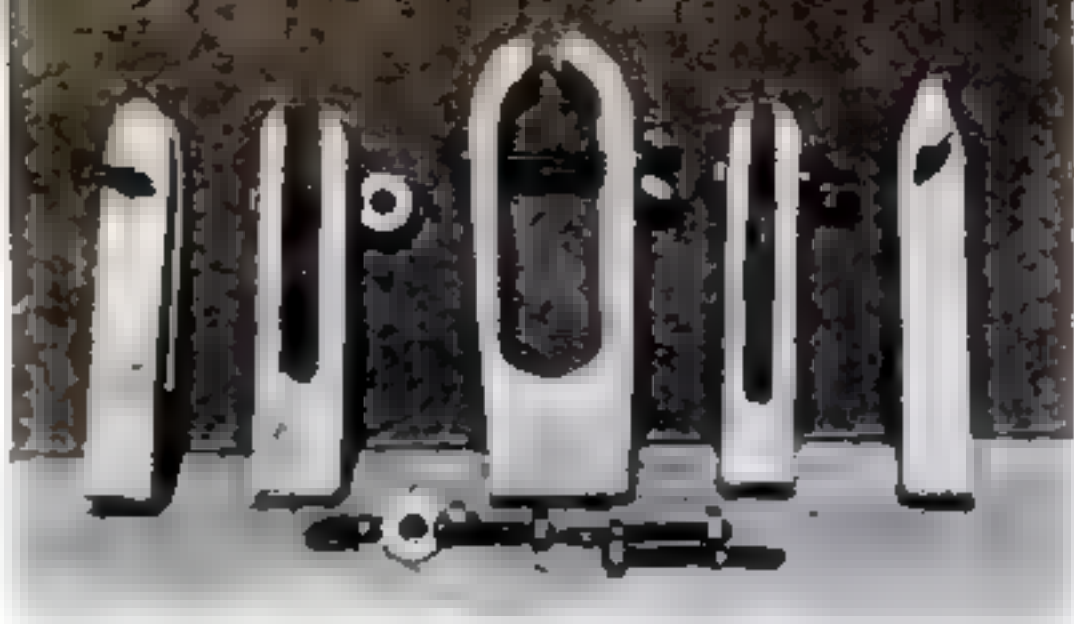






## Variety of Clamps Sawed from Scrap Pieces of Oak

WOODEN clamps served the purpose of one craftsman who did not have enough metal ones for the job. They were made from scraps of  $\frac{1}{2}$ " oak, some machine screws, and a few washers. A coping saw was used to cut the body of the clamps, and No. 10-24 flister-head machine screws were employed in lieu of the ordinary thumbscrews. To provide thumb-nuts for these screws, a simple but ingenious expedient was resorted to. A small washer was merely soldered into the slot in the



head of each screw. The clamps shown were used successfully in the delicate work of cementing a large quantity of lapping stones in their metal holders. They can be made in almost any size.—DICK HUTCHINSON.

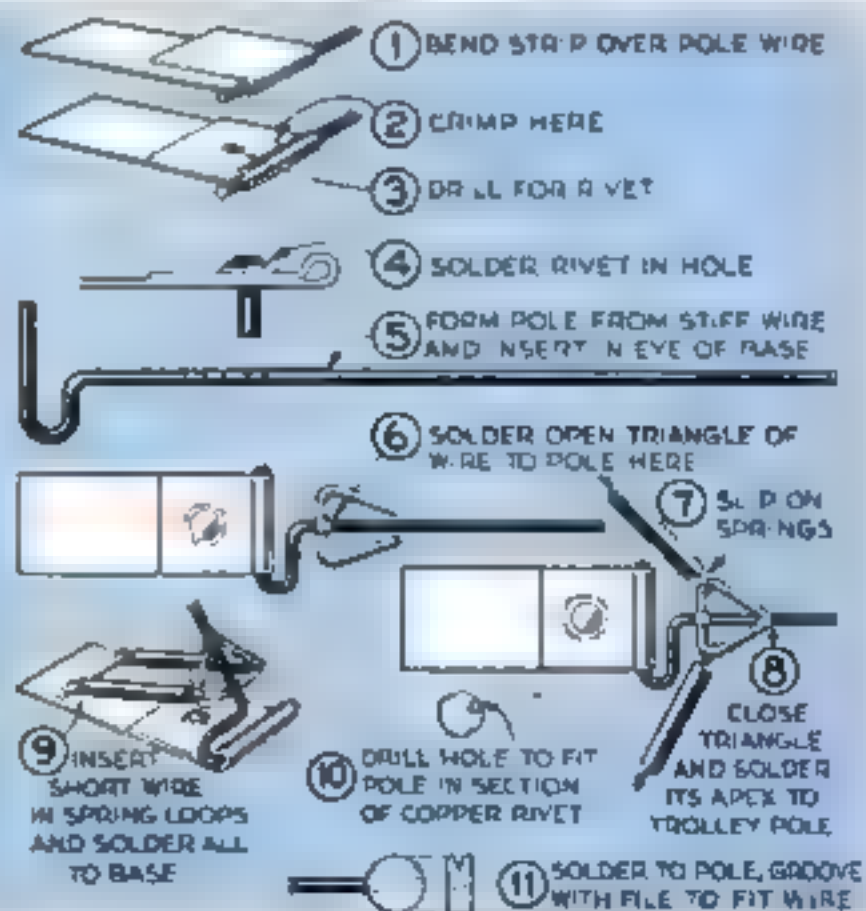
## Cleaning of Loose Joints Assures Firm Grip for Fresh Glue



NEGLECTING loose joints in chairs is generally to invite the eventual breaking of the end of an arm or a stretcher that is not loose. Loose joints should be repaired promptly, but prompt action will mean little unless the joints are thoroughly cleaned of old, dried-out glue before fresh glue is applied. It is important to remove hard glue from the hole as well as from the peg of a joint. This can be done with sandpaper wrapped around a pencil. If the sanding of both hole and peg leaves the joint loose-fitting, spread glue around the peg and lay two cloth strips on it crosswise as shown at the left; then daub glue in the hole and press the arm in place. For a very loose joint, use a disk of cloth in the same way.

## Model Trolley Pole Is Made of Odds and Ends

DRAWINGS at the right show how a home craftsman can fabricate an efficient model trolley pole from a few lengths of stiff wire and some odd bits of copper and brass. Designed for an HO-gauge line, the pole was equipped with coil springs made by winding piano wire around a piece of  $\frac{1}{16}$ " wire chucked in a hand drill held in a vise. The base was made by doubling a strip of brass around the length of bronze wire used for the pole. A pin through the car top served as the pivot. The trolley shoe was made of a rivet grooved with a file.—WILLIAM SCHOPP.





# Old Spark Coil Lights Welding Torch

**S**PEEDY and convenient, this automatic lighter for a gas brazing or welding torch makes a handy shop accessory. When you touch the torch tip against a washer at the top of the lighter, a fat spark promptly ignites the gas stream. The device is built of commonly available parts and takes but little time to assemble. A doorbell transformer, its primary or secondary circuit completed by a homemade switch, supplies current to an old vibrator-type auto spark coil. The high-voltage output is fed to a spark plug mounted so that its points extend slightly from the box which houses the lighter.

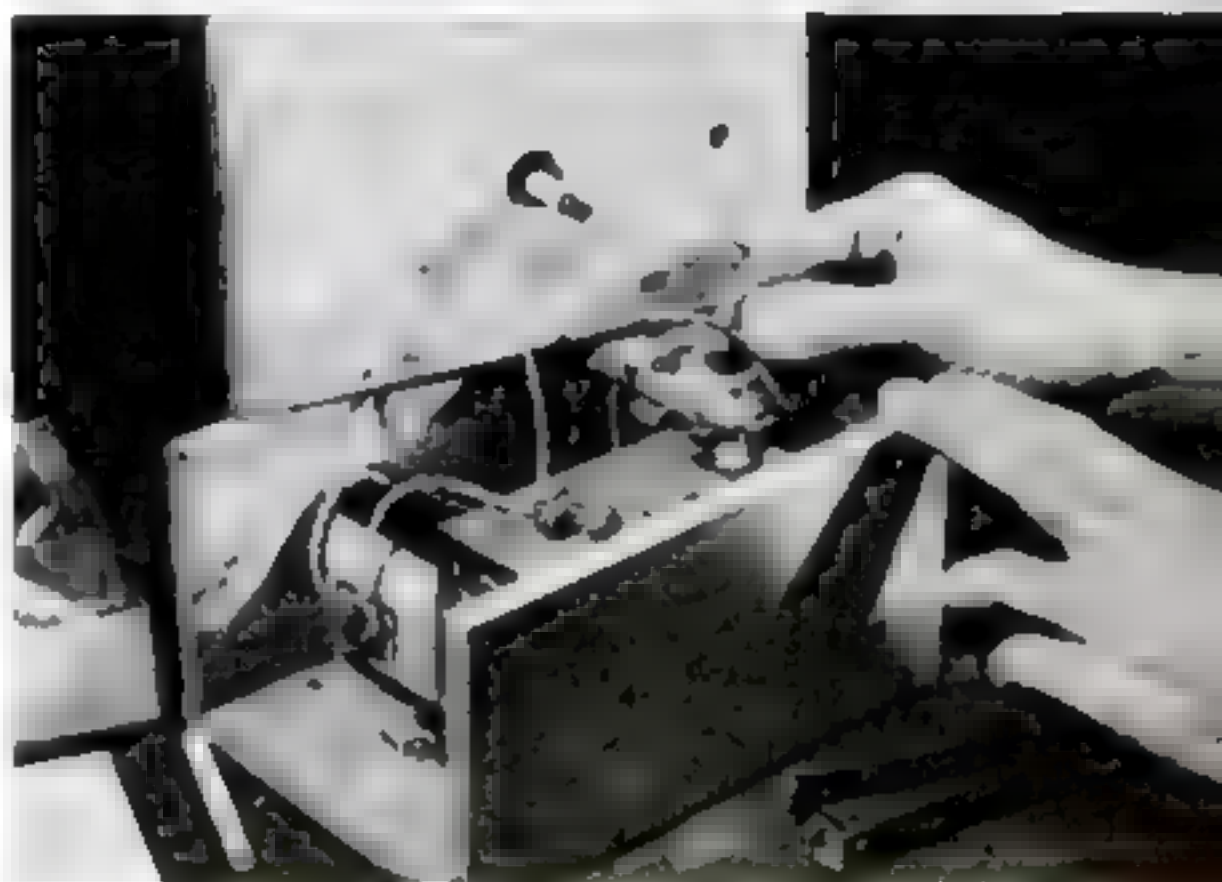
Construct the box of  $\frac{3}{8}$ " plywood, dimensioned to fit the coil and transformer you use. The box shown measures  $4\frac{1}{2}$ " by  $5\frac{1}{2}$ " by  $8\frac{1}{2}$ " on the outside. To facilitate any adjustment of the vibrator or switch, make the top and one end of the box readily removable. Near the center of the top, drill a hole into which a spark plug can be screwed until its points protrude about  $\frac{1}{8}$ ".

The switch required is one which will close the circuit whenever a dowel button is lightly pressed. Two strips of springy brass, shaped as indicated, are bolted to an insulating block—in this case a ceramic part salvaged from an electric stove—and mounted on a wooden support attached to a wall of the box. The switch is located directly beneath a second hole in the cover, and a length of dowel serves as a button, being depressed by the free leaf of a T-hinge on the cover.

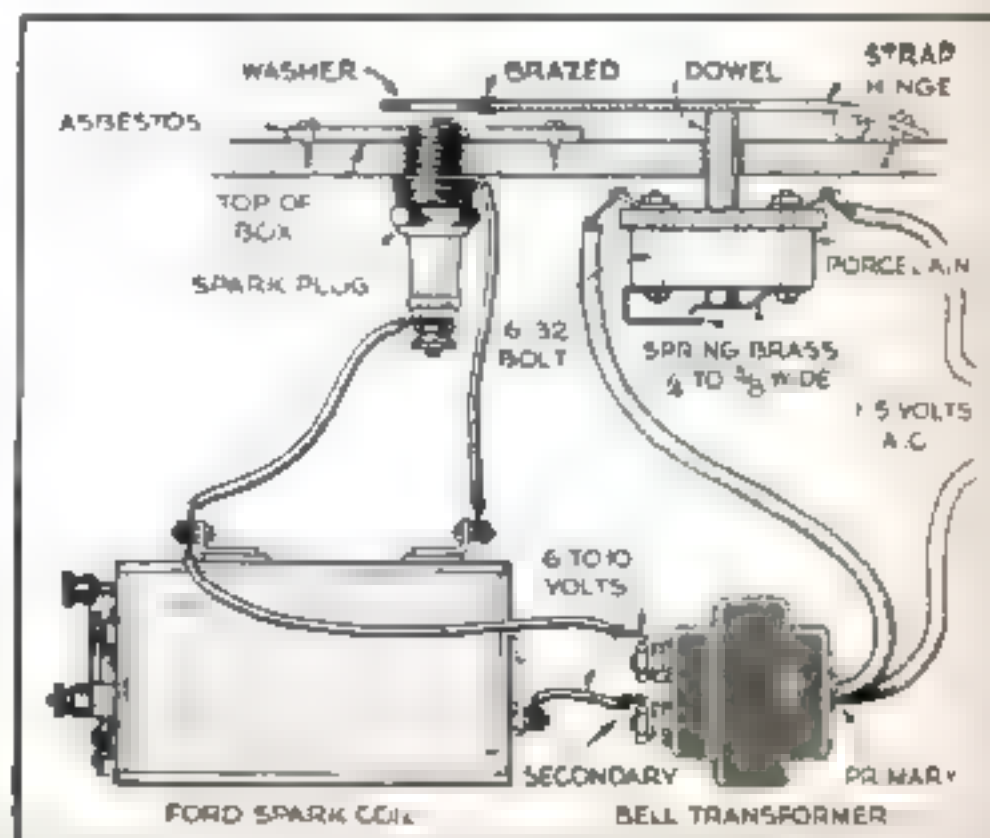
Before attaching the hinge, weld or braze a steel washer to the tip of the long leaf, where it serves as a ring for the torch tip. Mount the hinge so that this washer is directly over the spark-plug points, and cut the dowel at a length which will permit the washer to be about  $\frac{1}{4}$ " from the points when the switch is fully depressed. A 4' square of asbestos roofing or other fire-resistant material is secured to the cover for protection against heat from the torch.

To light the torch, turn on the gas and depress the washer with the torch tip. A brief tap, producing a spark that lasts but a fraction of a second, is generally all that is needed.—W. E. B.

FEBRUARY, 1944



When an unlighted gas torch is tapped against this automatic lighter, a spark ignites it with a pop. The doorbell transformer, coil, and spark plug are shown in the photo just above; below is the circuit.







**PARTS THAT MUST  
FIT ACCURATELY  
OFTEN CALL FOR  
TURNED TAPERS.  
PICTURES ON THE  
FOLLOWING PAGES  
SHOW THIS LATHE  
JOB IN EASY-TO-  
UNDERSTAND STEPS**

# Turning Tapers on the Lathe

**L**ATHE centers are a familiar example of taper fits, which are useful whenever parts must fit together without play and in precise alignment. Such fits have the added advantage that they can readily be taken apart when necessary.

One way to turn external tapers on a lathe is to swivel the compound rest to the desired angle. As its travel is limited to a few inches, only short tapers can be turned in this way. The base of the compound rest is graduated in degrees, and when it is at zero on the scale, its center line is at 90 deg. to the lathe bed. When swung to 90 deg. on the scale, the compound rest is parallel to the center line of the lathe. Since tapers are usually expressed with relation to the center line of the work, it is from this point that the angle is reckoned in setting the rest.

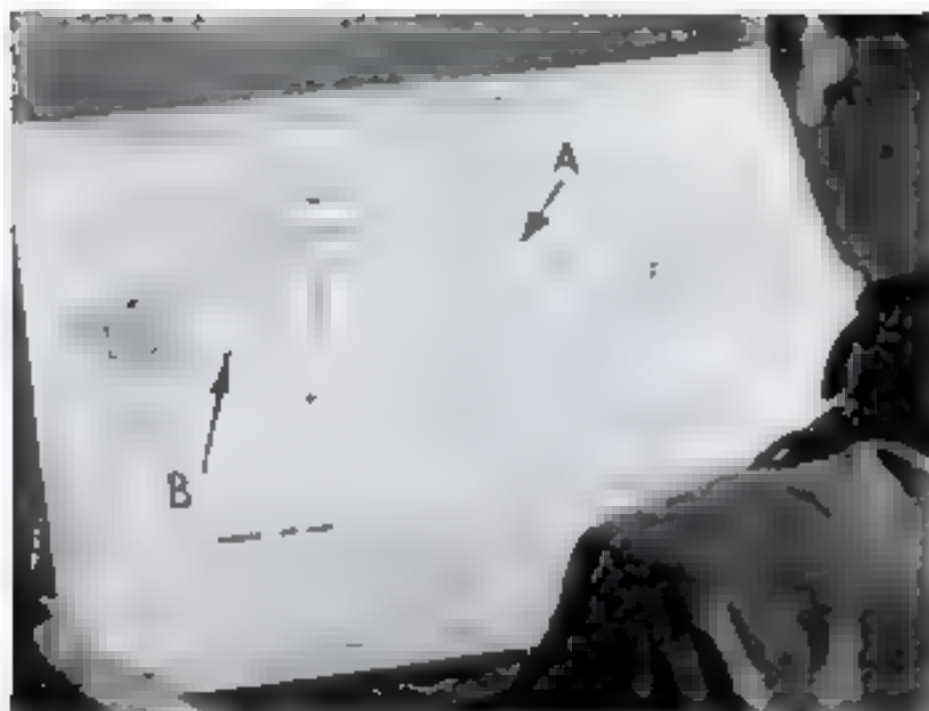
The lathe carriage must not move while the cut is being made, for the tool must be advanced only along the line of the compound rest. The depth of cut is adjusted by setting the tool in with the cross-slide feed screw.

Tapers up to 8" per foot can be turned with the taper attachment. This clamps to the lathe bed and has an adjustable bar that can be locked at an angle to the bed. The length of the taper that can be cut is limited by the length of this bar. A shoe that slides along it is clamped to the cross slide, and the screw that ordinarily secures the cross slide to the feed-screw nut is removed so that crosswise movement of the slide is governed entirely by the shoe. When the carriage is moved along the lathe by the longitudinal feed, the tool follows a path that is parallel to the taper bar. In this case, the tool is advanced after each cut by the compound-rest feed.

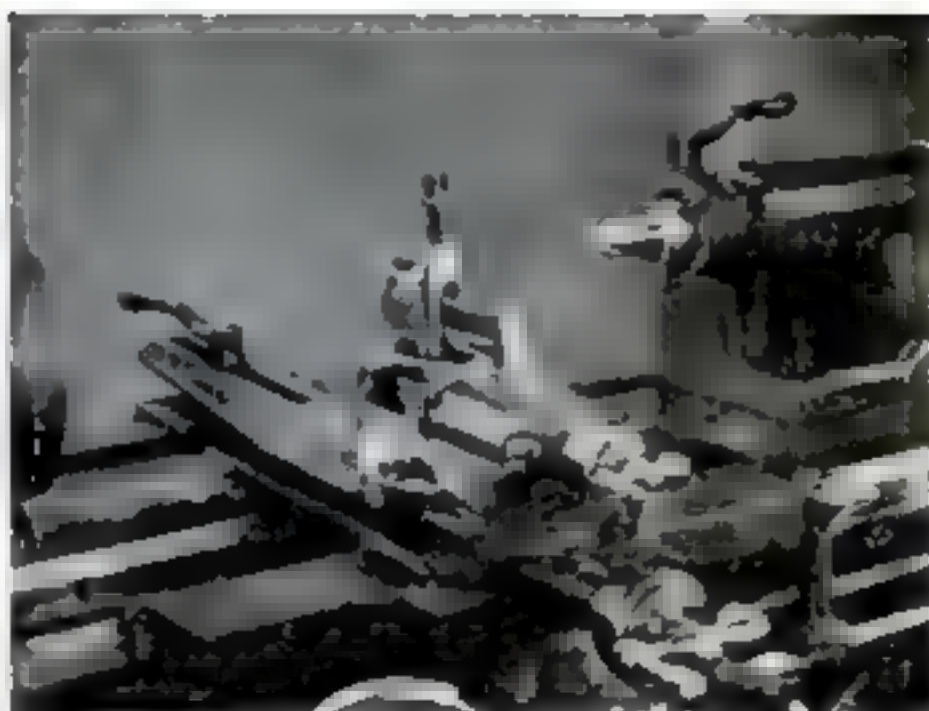
In cutting tapers by either method, it is vital that the tool be set *exactly* at center height. If it is above or below, the taper will not be correct.

Pictures on the following pages show the turning of tapers with the compound rest and with the taper attachment. These photographs were made from a sound film released by the U. S. Office of Education and distributed by Castle Films.

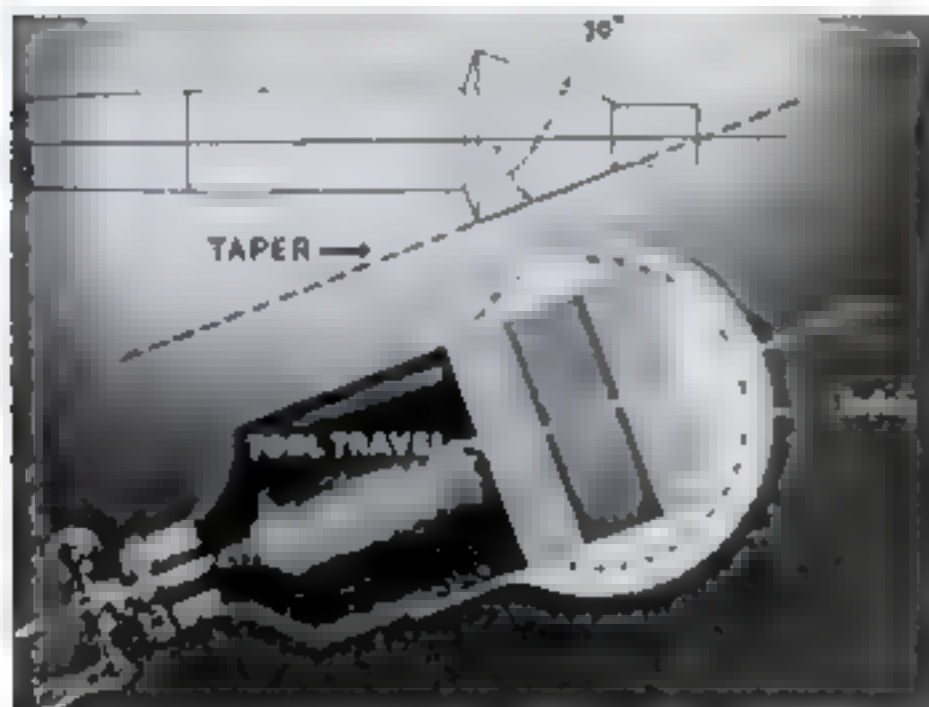




**1** Two tapers are specified on this drawing of a small shaft. The short, relatively steep one at A can be cut by means of the compound rest, while that at B will be made with the taper attachment



**2** The compound rest can be swiveled on the cross slide and locked at any angle. At zero on the scale, its feed screw is parallel to that of the cross slide and at 90 deg. to the spindle, as above



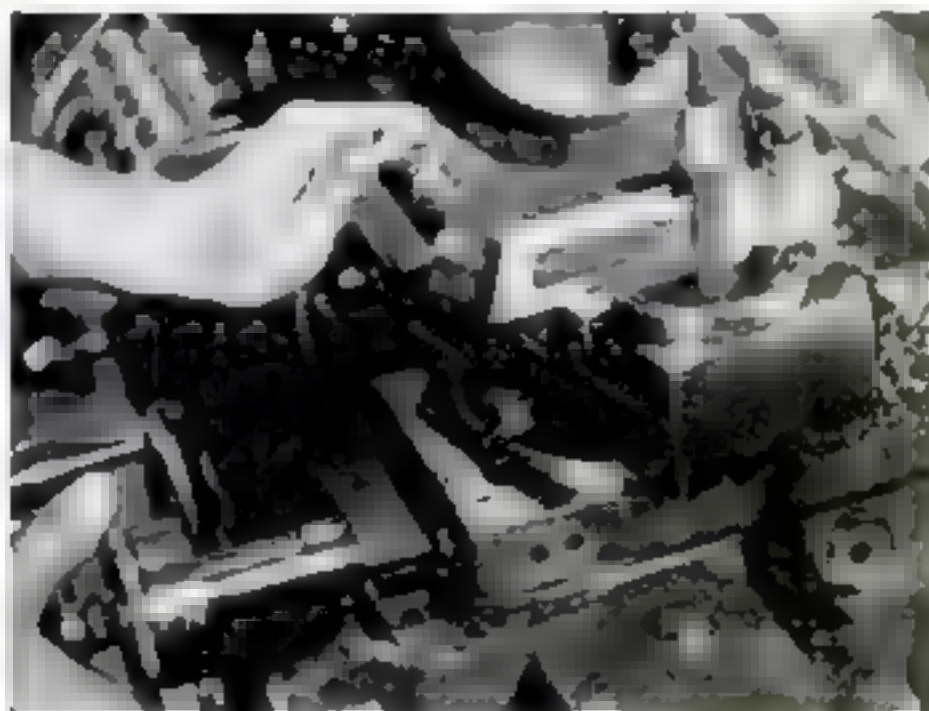
**3** For the 20-deg. taper, the rest is first swung to 90 deg. on the scale, which brings its feed screw parallel to the work center line, then back the desired 20 deg., when it will be at the 70 mark

**5** Were the carriage to move, tool travel would in part be parallel to the center line instead of at the desired angle, spoiling the taper. Therefore the carriage is locked as shown by the arrow below

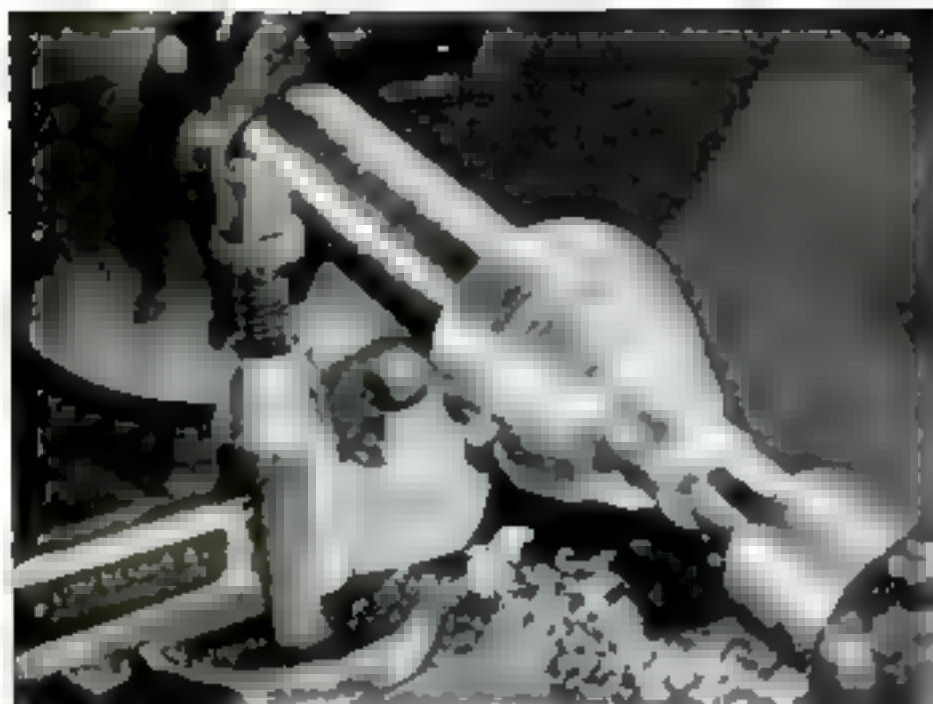


**4** Two nuts are tightened to lock the rest at this angle. It will advance the tool on a line at 20 deg. to the center line of the work. This, already turned except for the tapers, is mounted on centers

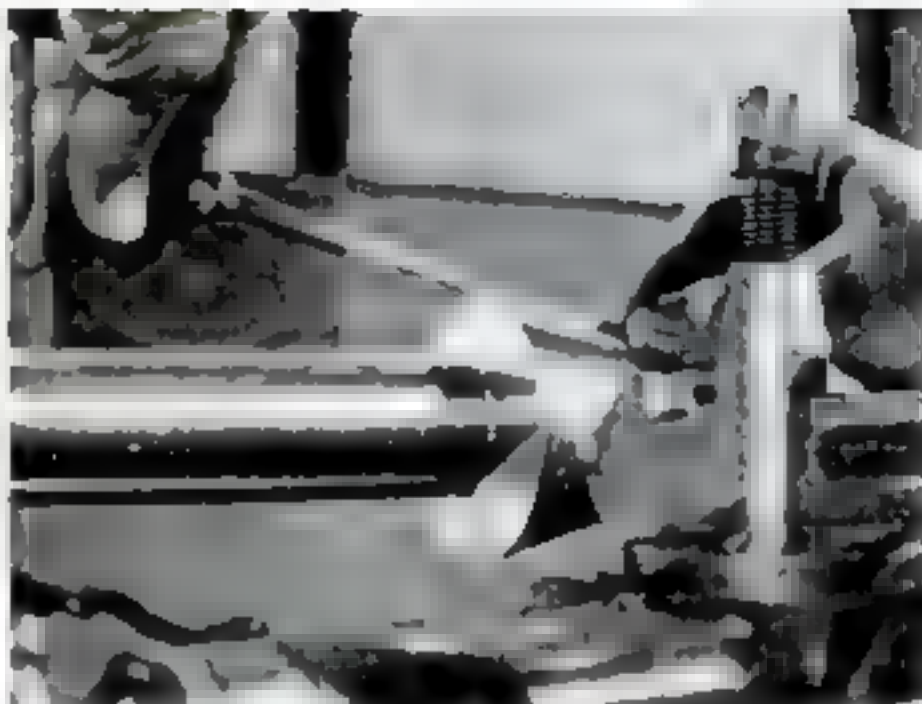
**6** With the cross feed (at bottom left) the tool is set to a depth of cut depending upon the speed, type of tool, and metal being turned. Too heavy a cut may swivel the rest slightly, causing inaccuracy



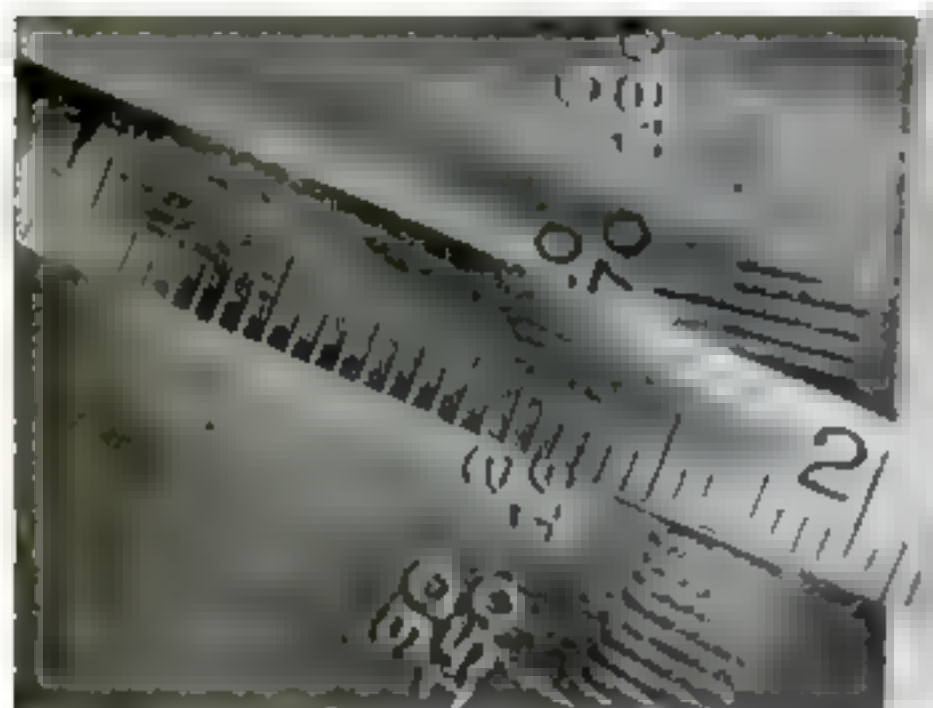




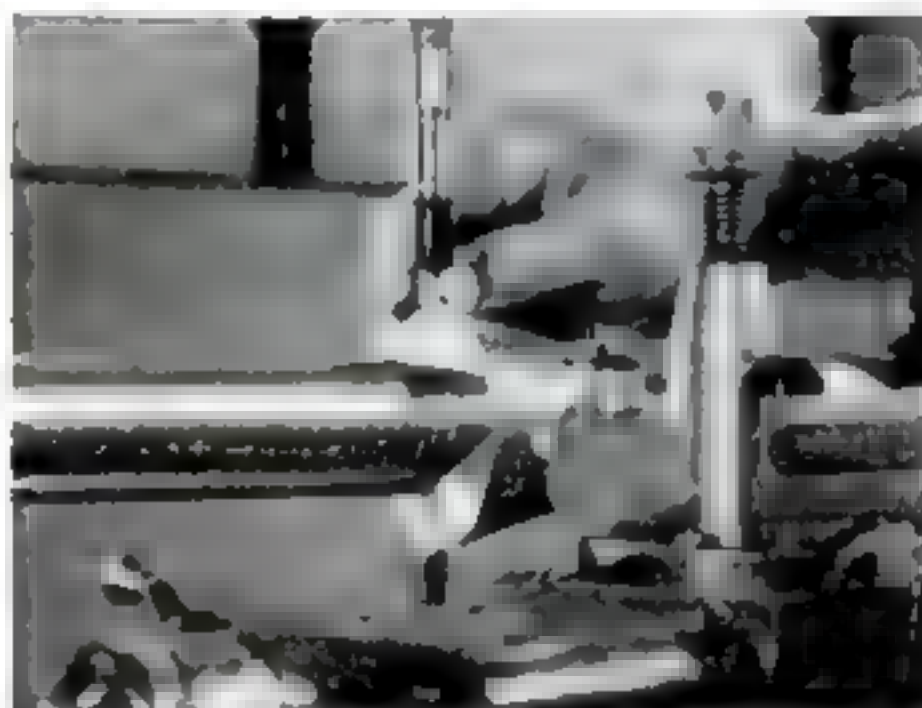
**7** Only the compound-rest feed is used to traverse the tool from right to left across the work in cutting the taper. After each pass, the tool is advanced by the cross-slide feed screw for a new cut



**8** After a trial cut, the taper must be checked. This can be done with a bevel protractor. The base of this instrument must be set on a machined surface, in this case the straight part of the work



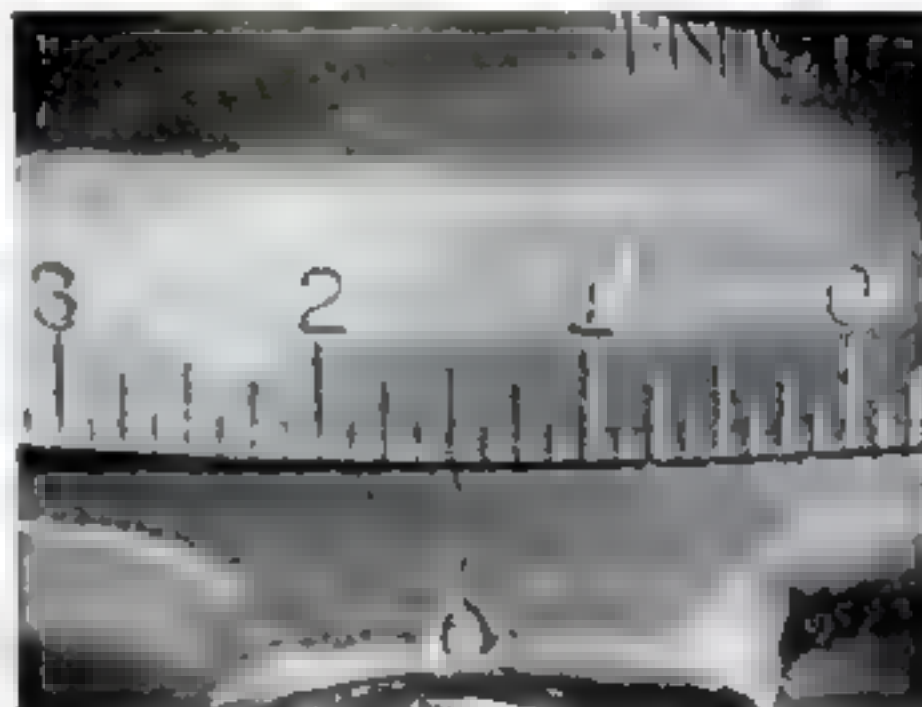
**9** Since the protractor arm lies exactly on the 20-deg. mark, the setup is correct. Were it not, the rest would be reset for new trial cuts. A taper ring gauge would check both size and taper



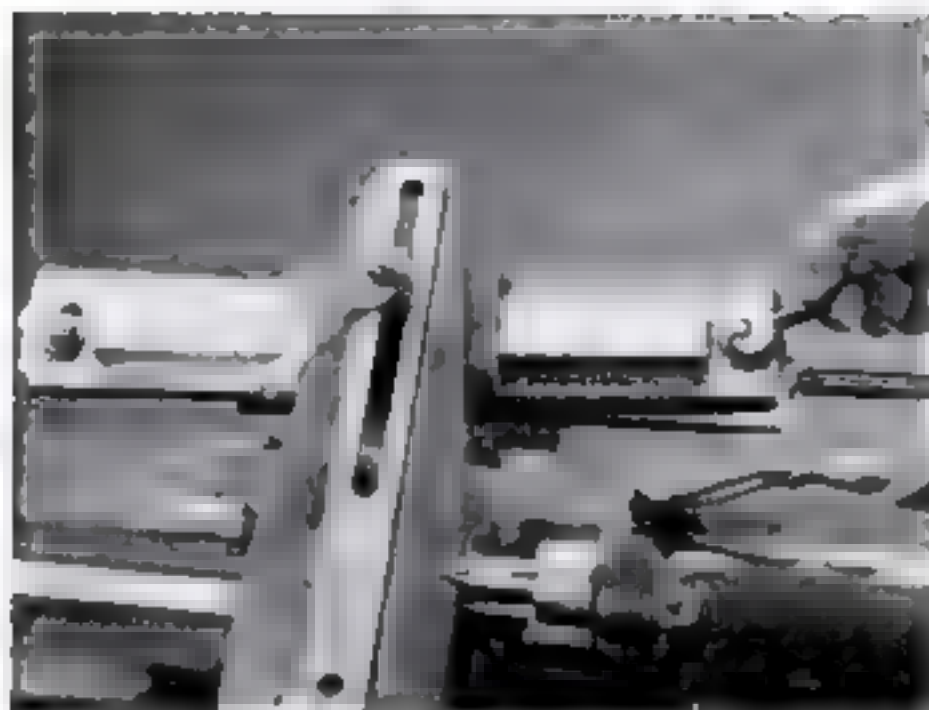
**10** A micrometer may be used to measure the big end. Any oversize is noted and one or more cuts are made until the tool has been advanced far enough by the cross feed to remove the excess metal

**11** For slight tapers, long or short, the taper attachment is useful. It consists of a bar that can be locked at an angle to the bed and a sliding shoe which can be clamped to a slotted cross slide

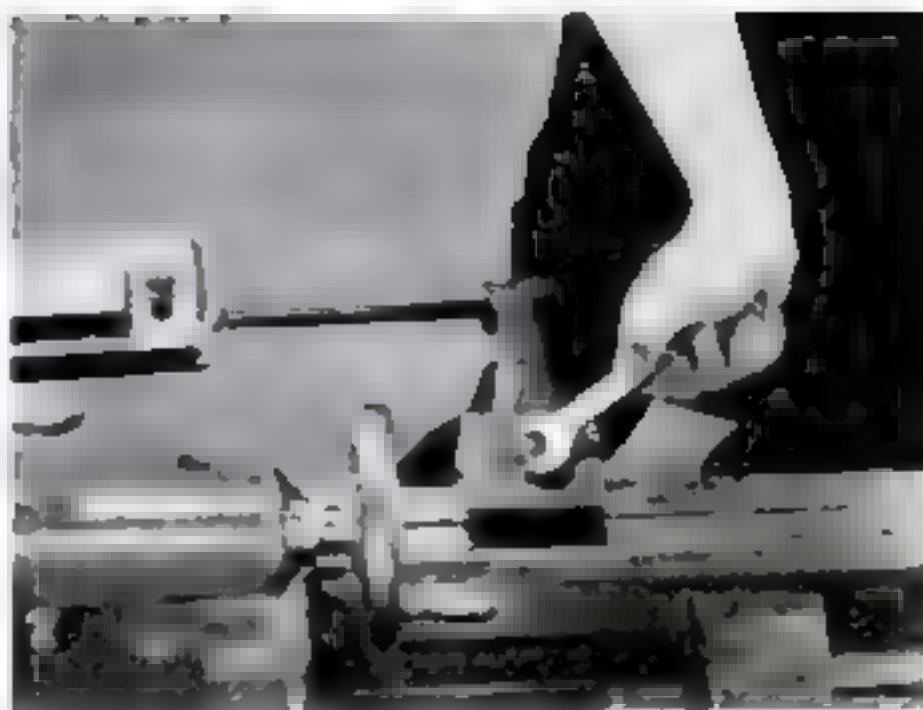
**12** At the right end, the taper bar is graduated in terms of inches of taper per foot. The job calls for a  $1\frac{1}{2}$ " taper. Therefore the  $1\frac{1}{4}$  mark on the bar is aligned with the index mark on the fixed base



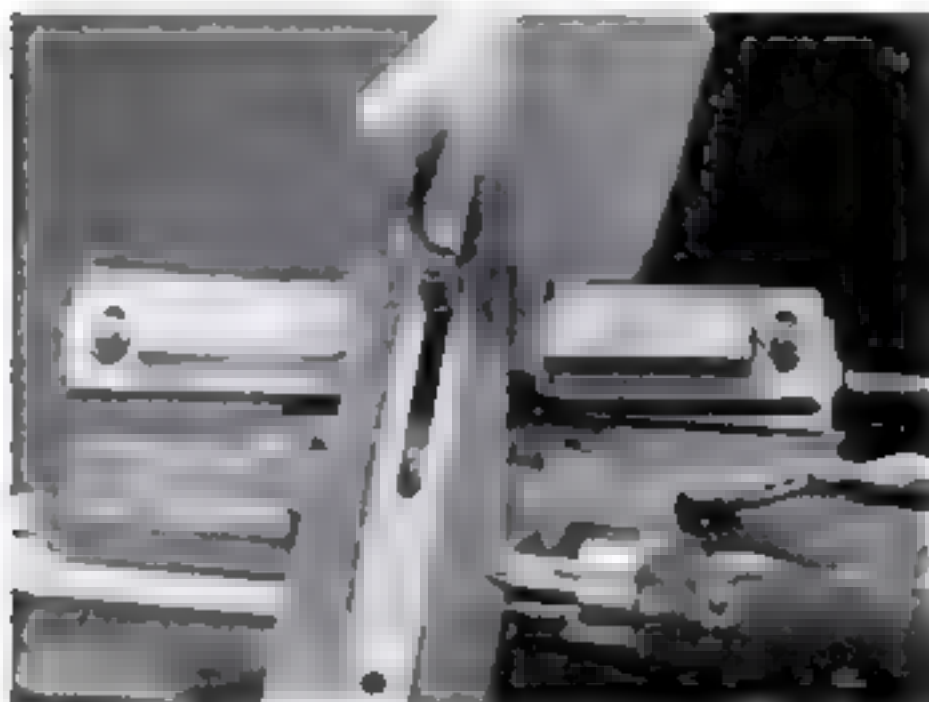




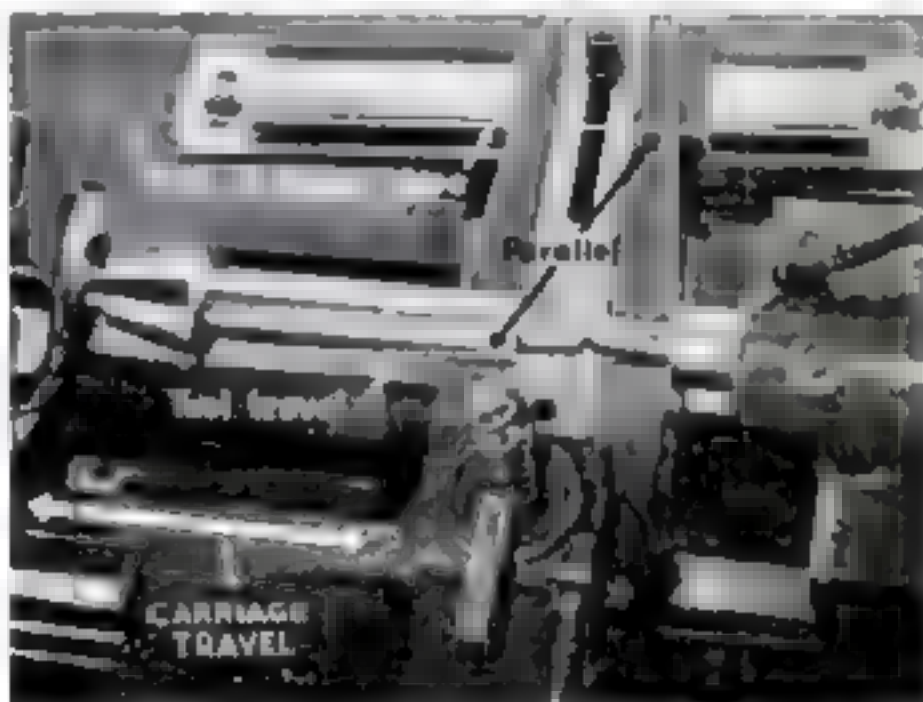
**13** The bar swivels on a pivot set midway between the slots. When it has been adjusted to the desired setting, both clamping bolts are tightened, care being taken not to alter the setting meanwhile



**14** If the taper attachment were to move during the turning operation, an inaccurate cut would be sure to result. It is therefore wise to tighten the bracket that clamps it to the lathe, as above

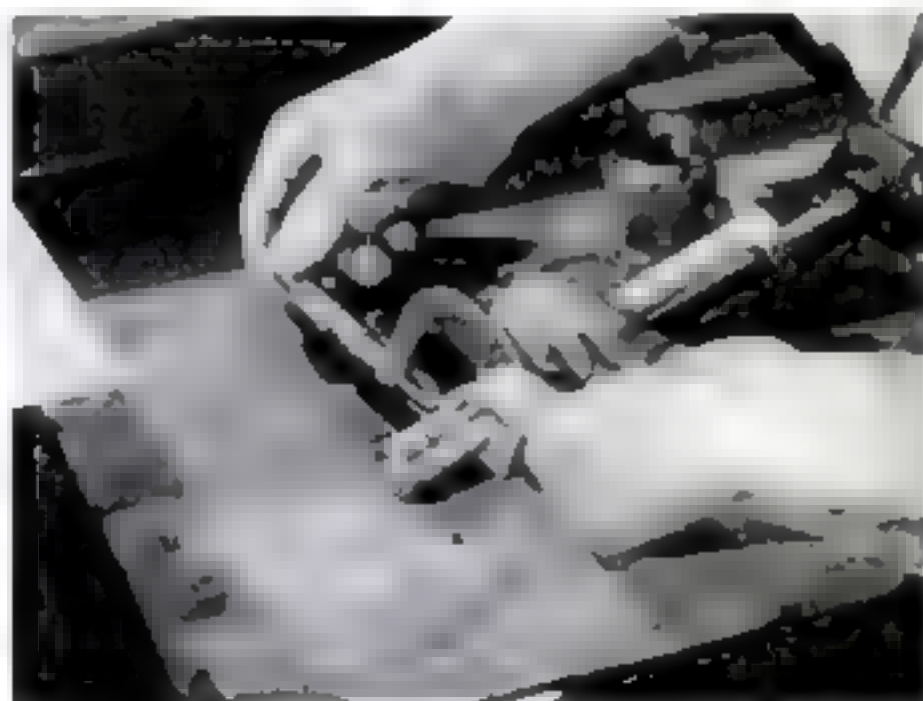


**15** A clamp handle locks the sliding shoe to the slotted cross slide. The screw that usually secures the slide to the cross-feed nut has been removed, as may be seen at the bottom of this photo



**16** Since the traverse of the cross slide is now governed by the sliding shoe, tool travel is parallel to the taper bar as the carriage moves. The tool is fed into the work by the compound screw

**17** After a trial cut, the taper can be checked with a taper ring gauge. A gap between gauge and work shows that the taper is too small on the large end. The taper bar is readjusted accordingly



**18** Since the large diameter of this taper is the same as that of the shaft, the small end is measured. If a micrometer is used, its contact surfaces are set back from the end half their diameter



# NEW SHOP IDEAS

**CUTTING HEAVY TUBING** that weighed 150 lb. per foot was a problem that confronted F. J. Valentine, Inc., in an effort to make prompt delivery of sub-chaser parts to the Navy. Power-saw equipment was not obtainable, and job shops were too busy to take the work. So the Brooklyn manufacturer ransacked his plant for odd parts with which to improvise the unimposing but practical contrivance shown at the right. In addition to other miscellany, the device included an old drill press, and the whole setup served to support and rotate the tubing beneath a

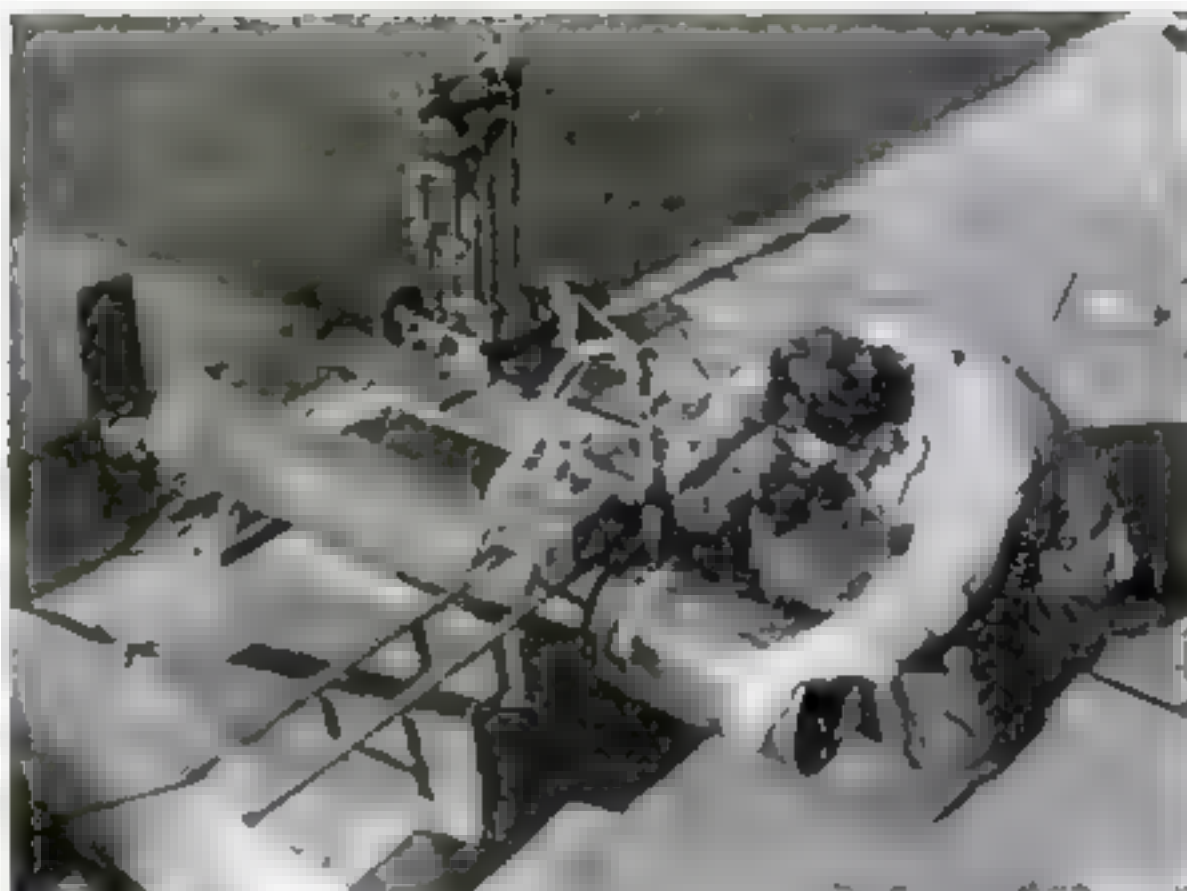
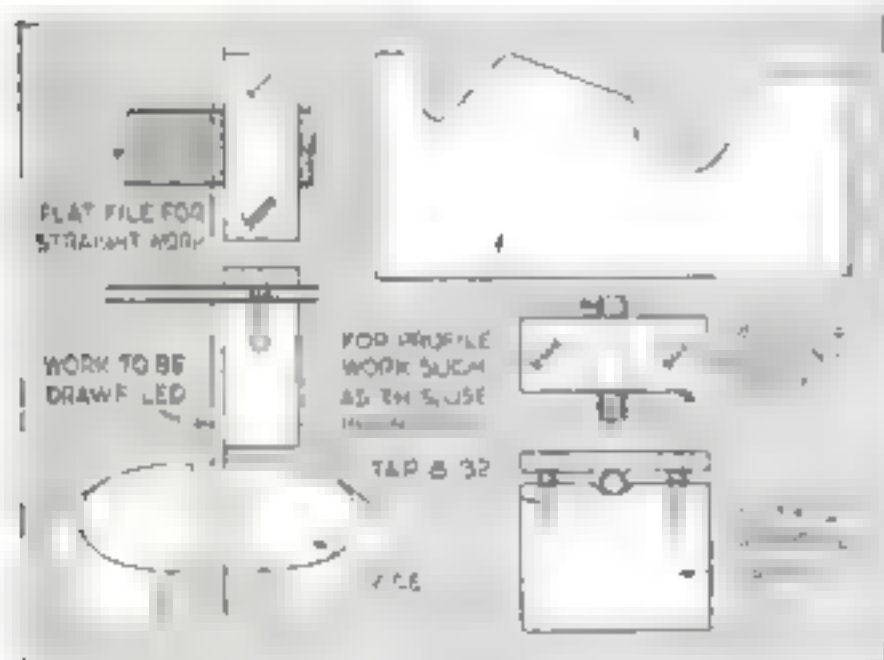


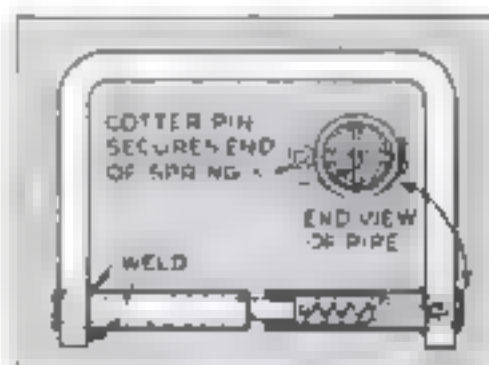
Photo courtesy of F. J. Valentine, Inc.

stationary cutting torch. The drill press, by means of a reduction gear, turned the tube at a speed of  $\frac{1}{4}$  r.p.m. by reeling in a wire wrapped around it. End play was prevented by slanting the tube against an end roller.

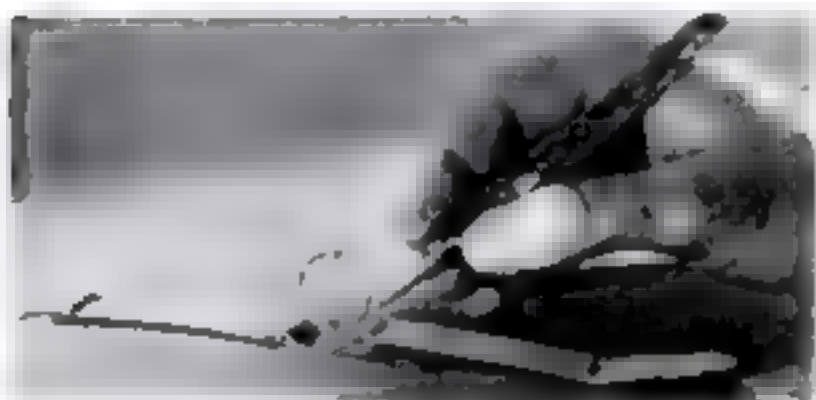
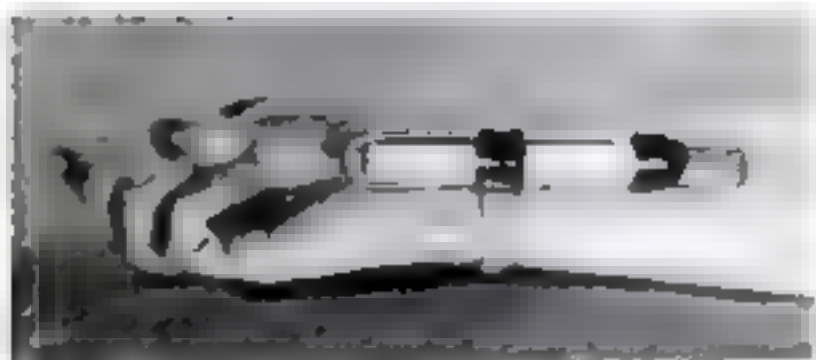


**DRAWFILING SQUARE EDGES** of dies, gauges, and templates is made easy by the handy little tool illustrated above, which utilizes a flat or a curved file depending upon whether the profile of the workpiece is straight or curved. The device consists simply of a base of cold-rolled steel,  $\frac{1}{2}$ " by 1" by  $1\frac{1}{4}$ ", and a clamping piece of the same material,  $\frac{1}{8}$ " by  $\frac{1}{2}$ " by  $1\frac{1}{4}$ ". Two screws attach the clamp to the base, as shown in the drawing. A half-round groove shaped in the head of the base accommodates a round file when a curved edge requires one. When clamped securely, a file is bound to cut a profile squarely if the base of the device is held firmly against the work. The tool can be used to make both male and female gauges. It will enable an operator to split a line and work off high spots easily.—H. D. CHAPMAN.

**TEMPLATES BY THE DOZEN** can be classified and racked in ready accessibility by hanging them on bars arranged in a holder as shown below. The holder may be of any size, but the bars consist of  $\frac{1}{4}$ " tubing welded between the legs of a succession of steel U's bolted upside down to a frame of strong piping. Within these U's the tubing is divided by a gap of  $\frac{3}{16}$ " bridged by an interior spring bolt beveled on the lower side like that of a door lock. Templates will not slide downward past this bolt, but the bolt will retract if they are lifted a bit, and then they can be pulled out sideways. The device was invented by Ben Kruce, of North American Aviation, Inc.





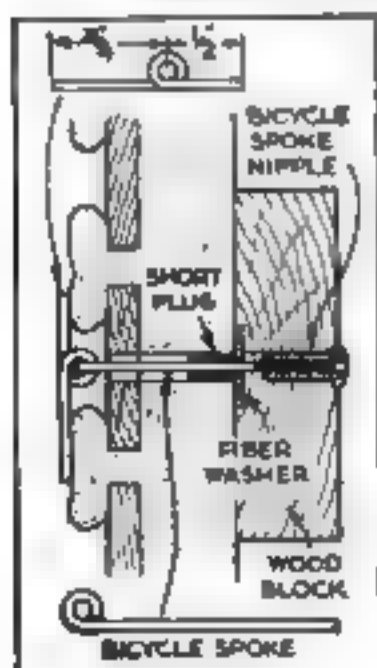


**CONVERTING A FLASHLIGHT** into a wrist light that will leave both hands free for a job can be accomplished with an inexpensive watch strap and two paper clips. Straighten the clips, slip one through each loop of the strap, and center them; then bend them, as shown above, into circles of a size to fit the flashlight snugly, and solder the ends together neatly.—R. S.

**SHELLACKING CARDBOARD BOXES** which contained nail sets, bits, sharpening stones, or similar small tools will strengthen the cartons sufficiently for permanent shop use. A first coat of shellac should be diluted with alcohol, but the second should be applied full strength. Household boxes can be treated in the same manner.—K. BIER.

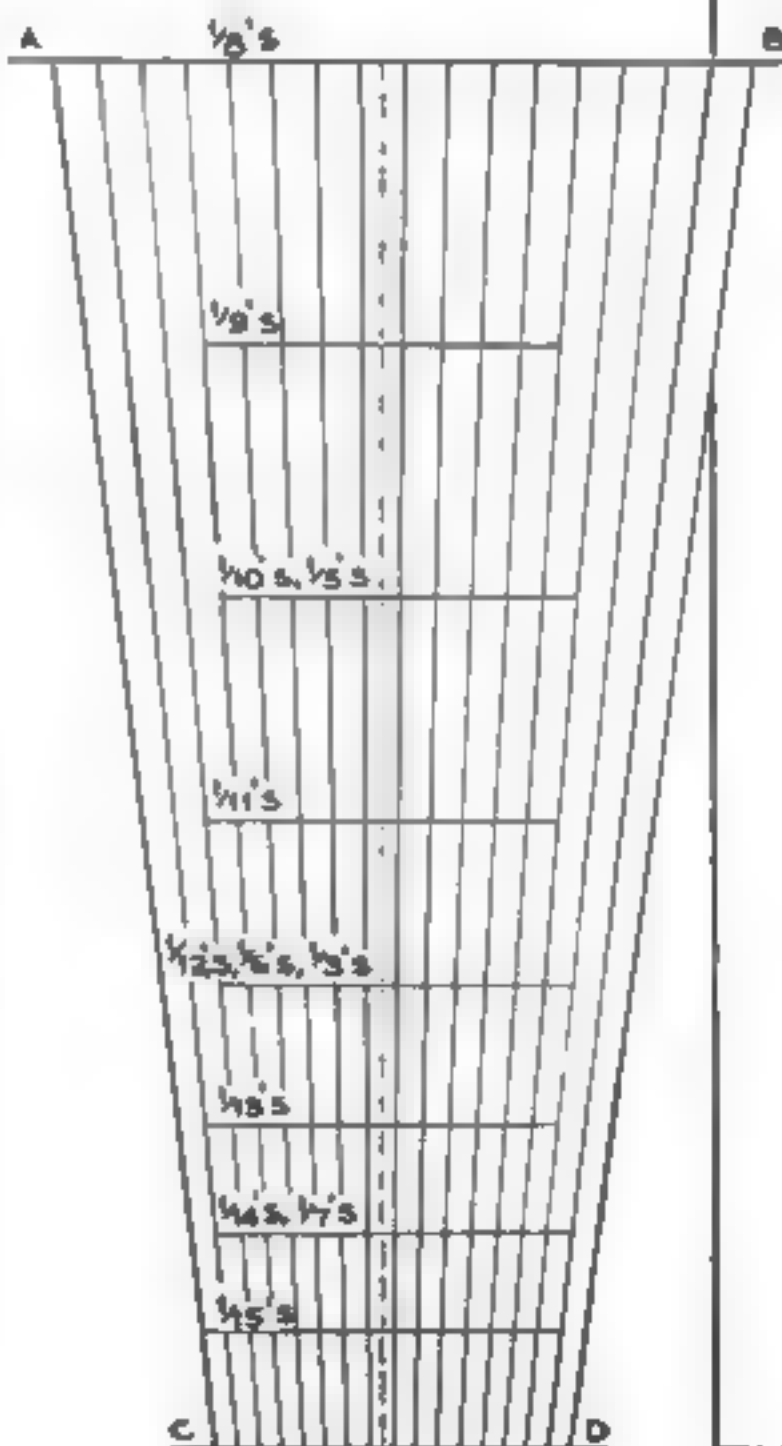
**TOGGLE BOLTS** of practically any length can be fashioned from two pieces of wire joined as in the drawing, according to an article in the British magazine *Mechanics*. How such a bolt

may be used to hold a block on a plaster wall is shown at the left. The hole in the wall must be big enough for the loop of the toggle to pass through. A bicycle spoke makes a good bolt, being already threaded to take a spoke nipple, but any wire that has a thread can be used for the bolt. Wings looped long on one side will drop into a vertical position.



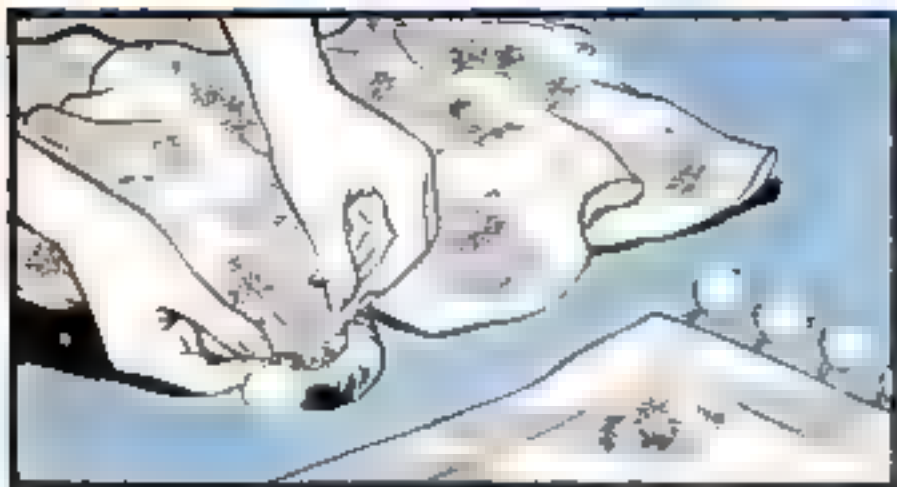
**A DRAFTSMAN'S RULE** divided into fractions other than the more common ones is reproduced full size at the right, and the method by which it was divided is shown below. Draw the parallel lines *A-B* and *C-D* 4" apart. Mark off 1" in sixteenths on *C-D*, erect a perpendicular center, mark off 1" into eighths on each side of center on *A-B*, connect corresponding points with straight lines, and add a dotted line halving the first division left of center.

Even fractions are obtained by holding a ruler at right angles to the center line and moving it up and down until a 1" interval is divided into the desired number of units. Odd fractions can be obtained by using the dotted line as a perpendicular. Celluloid engraved with a penknife and a little India ink makes a lasting rule.—FRANK SHORE.





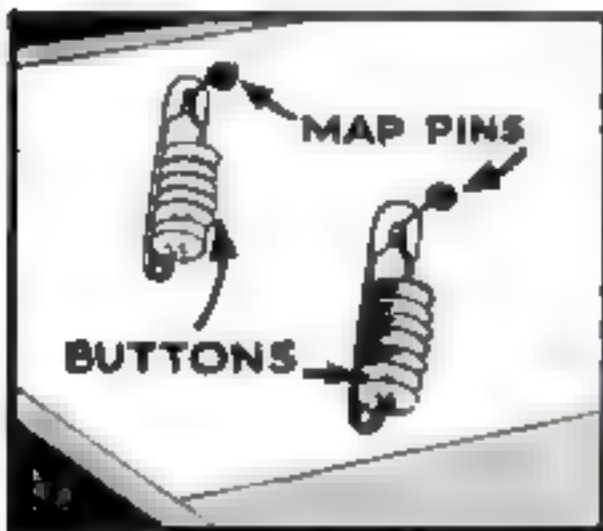
# KEEPING THE HOME



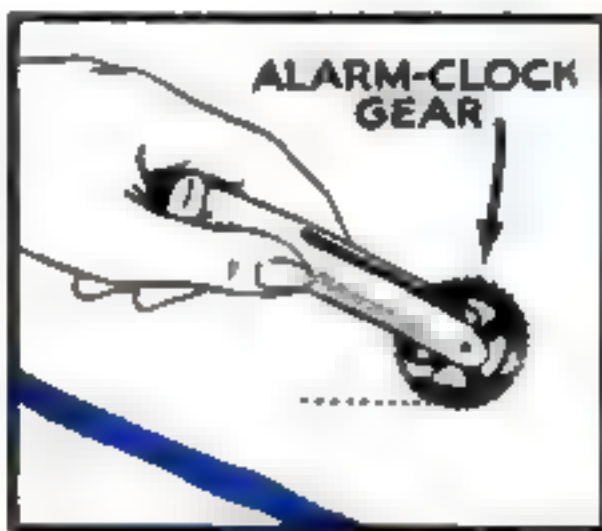
Ball fringes will stay soft and fluffy after the rest of a curtain has been starched if the balls are gathered together and tightly encased in an oiled-silk bowl cover before the curtain is put in the starch. Tie the cover snugly with string



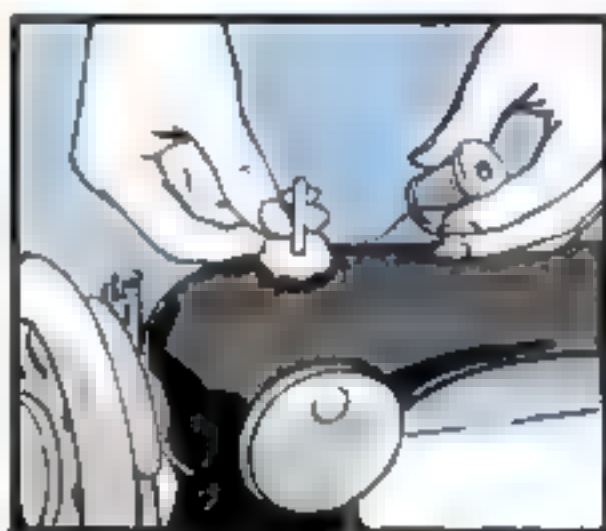
A wad of chewing gum will quickly lose its grip on woolen clothing or other such fabric if it is thoroughly chilled with a piece of ice. The ice will work just as well if it is wrapped in oiled silk to prevent water stains on delicate goods



You won't have to look for matching buttons if you string these of a kind on safety pins as the buttons slowly accumulate. Suspend the strings on map pins



Held in the fork of a clothespin with a catter pin as an axle, an old alarm-clock gear will make a handy tracing wheel, excellent for copying patterns and the like



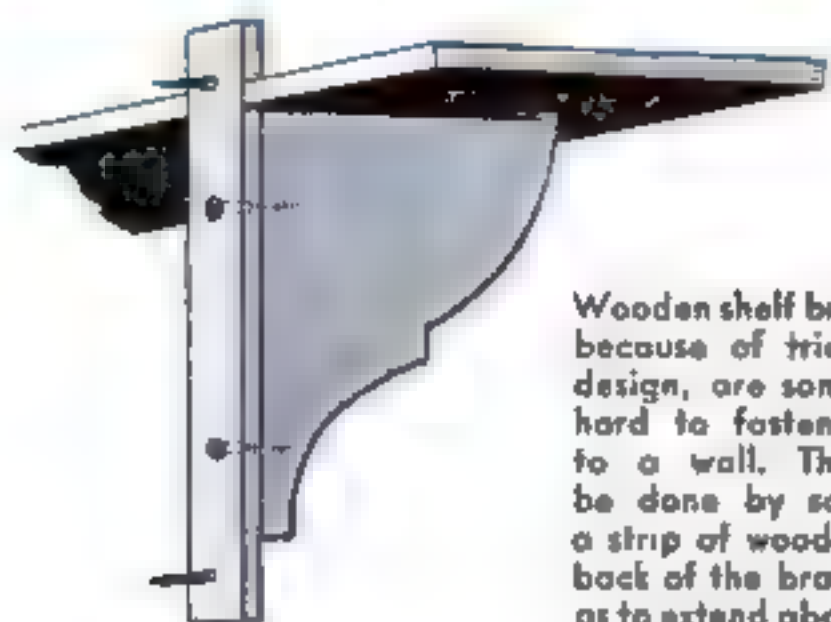
Silk thread will not tend to unwind too fast on your sewing machine if the motion of the spool is retarded with a bit of felt slipped over the spindle

If you would add a touch of novelty to the hearth in your living room, save up a generous supply of orange peels and dry them well. Because of their oil content, dried orange peels kindle quickly and burn with a pleasant aroma. If you lack a grate, fashion one out of a shallow box held up by andirons. Holes in the box near the bottom help the fire to catch quickly

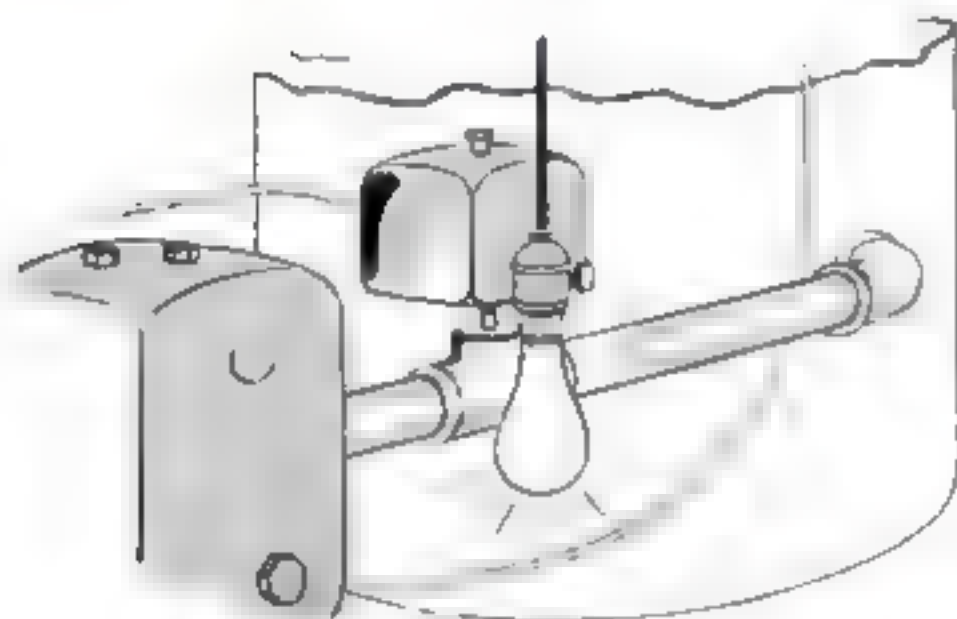




# SHIPSHAPE



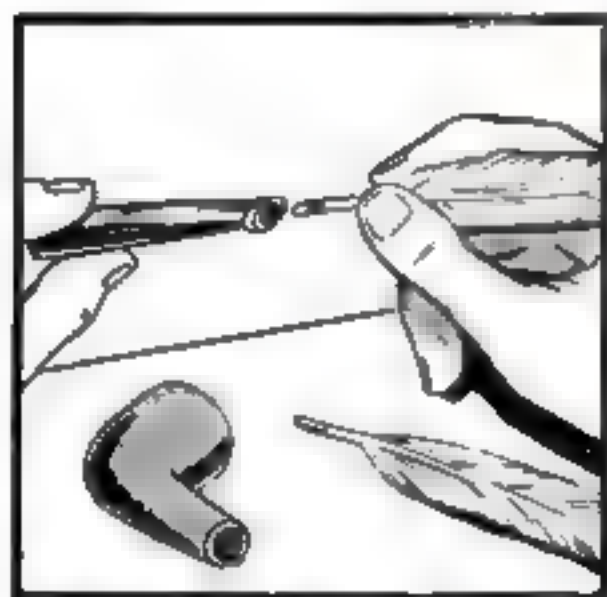
Wooden shelf brackets, because of triangular design, are sometimes hard to fasten firmly to a wall. This can be done by screwing a strip of wood to the back of the bracket so as to extend above and below it as shown here



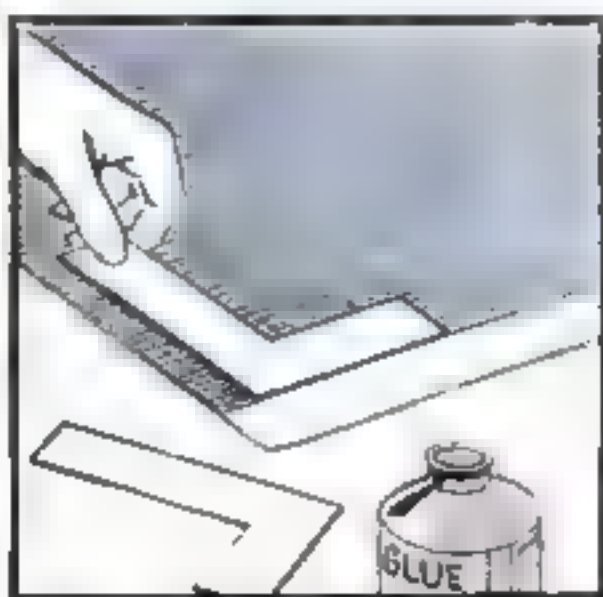
Don't let a cold snap put your water pump out of commission, if such a mechanism is part of your household plumbing. The  $\frac{1}{4}$ " pipe connection to the pressure switch will be the first to freeze. Guard this critical point simply with the warmth from a light bulb resting against the connection



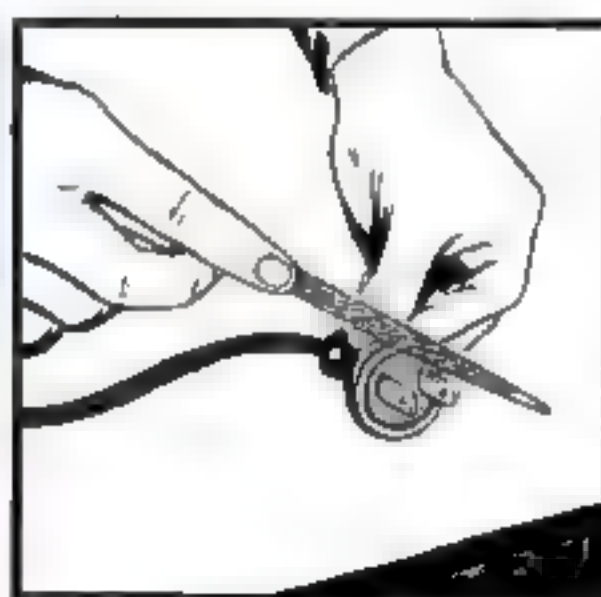
No dark recess of a cellar or attic will be hard to illuminate with a portable bulb and extension cord equipped with a suspension device like the one shown above. This combination hook-clamp will enable you to hang a light almost anywhere. Cut the hook off a wire clothes hanger. In the leg of a spring clothespin, bore a hole to take the shank of the hook, and tape the joint well



Try chicken feathers in lieu of pipe cleaners if the latter are hard to obtain in your locality. They do a good job if twisted as they are put through a pipe

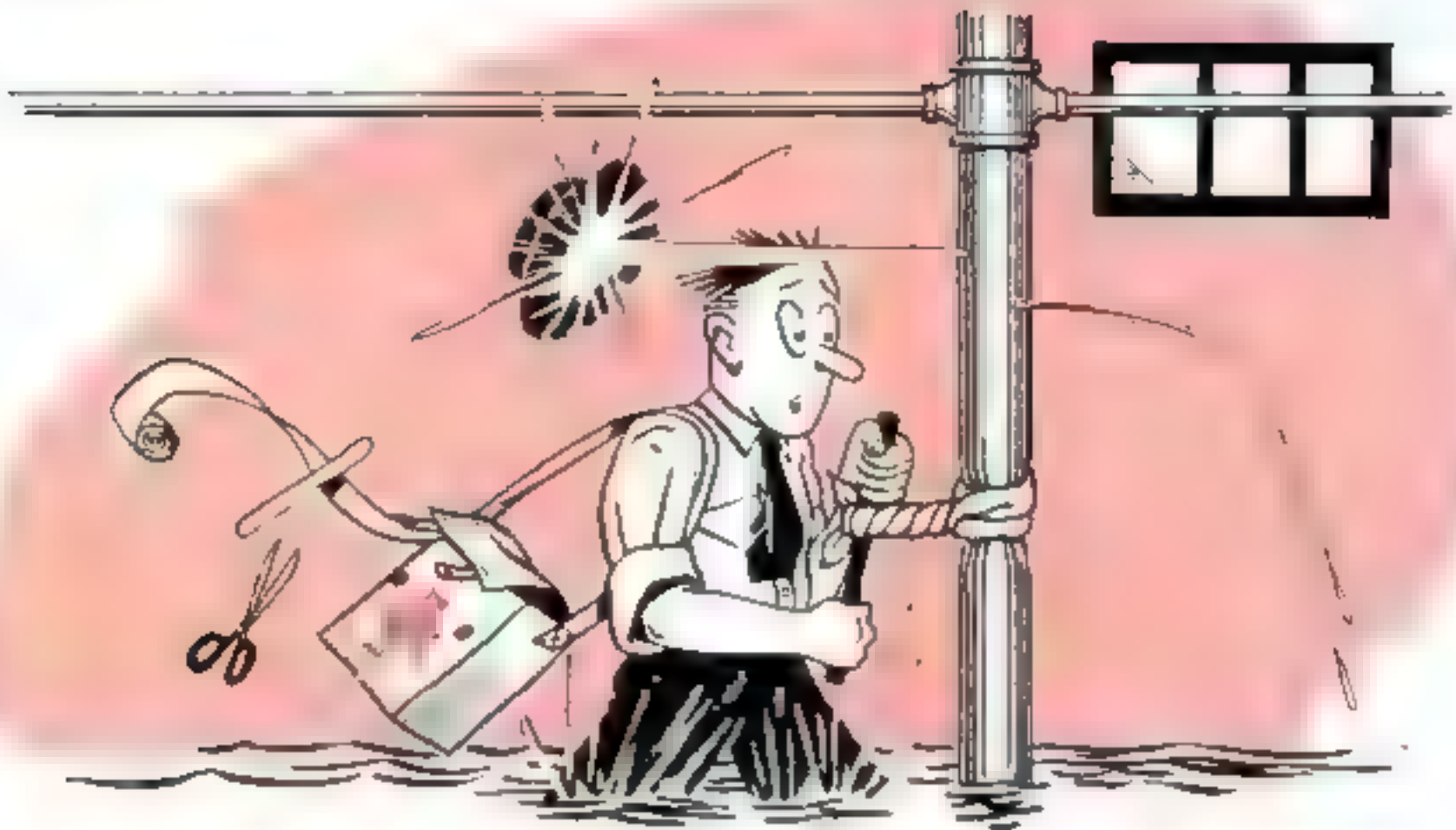


Curled corners of small rugs will not menace the unwary footstep if L-shaped pieces of cardboard are glued to the undersides. The L's stiffen and flatten the corners



File a flat spot on the top of a light plug so you can feel when the prongs are aligned properly. It will be a help when you insert a plug in a dimly lighted outlet





# FIRST AID FOR SICK PLUMBING

By JOHN MODROCH

**W**AITING for the plumber while the bathroom floods is funny in the comic strips, but in real life it is scarcely amusing. To dodge such an unpleasant situation, it's a good plan to cultivate at least a nodding acquaintance with your home plumbing system. Then you'll not only be able to handle plumbing emergencies, but you'll also be in a position to take care of minor difficulties before they develop into major repair bills.

Cleanliness is of first importance. A faucet, trap, or any other fitting that accumulates scale or waste matter has its capacity reduced continually until actual stoppage occurs. And, no matter when this happens, it will probably catch you when you would rather it hadn't. Open unused faucets occasionally and run off trapped water, drain the rusty water from the bottom of heaters and other storage tanks a couple of times a year, and wipe the sediment from the inside of toilet flush tanks once in a while. Regular attention to such small things as these reduces wear on all parts of your plumbing system by keeping the water free of clogging and abrasive accumulations.

Much of the waste system of your plumbing, unlike the supply part, is protected from corrosion to some extent by the soap and grease that runs through it, but soap and grease cause stoppages in their own

right unless adequately flushed out. Hot water is better than cold for this purpose and, if plentiful, should be used generously, especially in a kitchen sink. Where the supply of hot water is limited, the periodic use of a safe commercial flushing chemical is advisable.

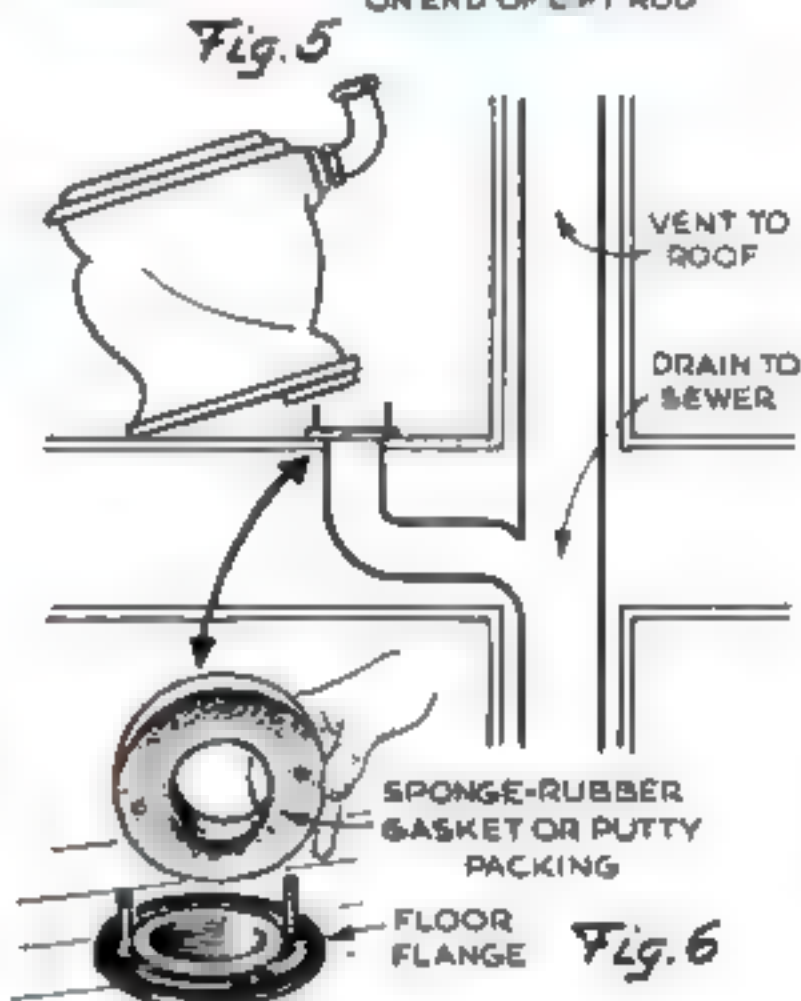
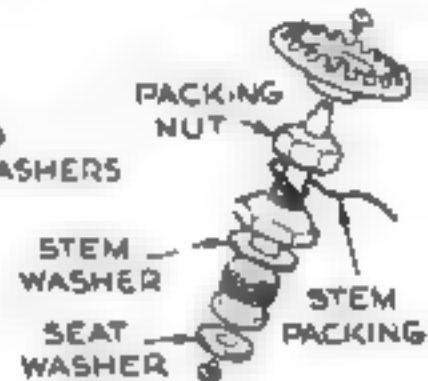
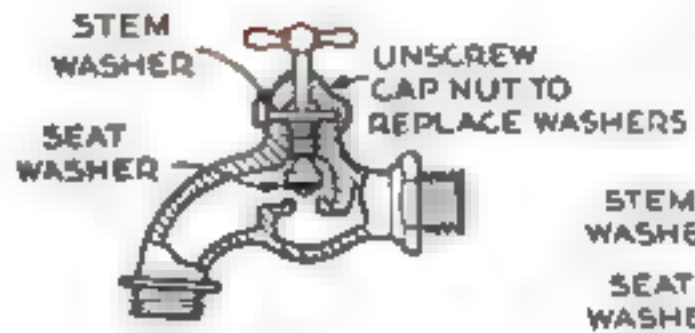
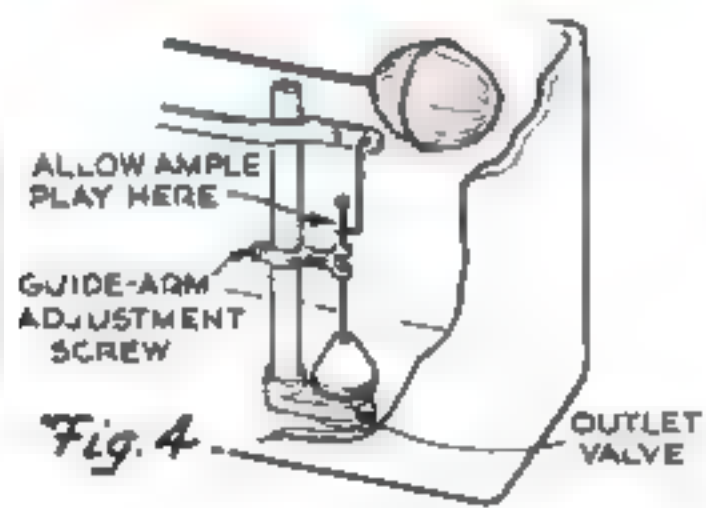
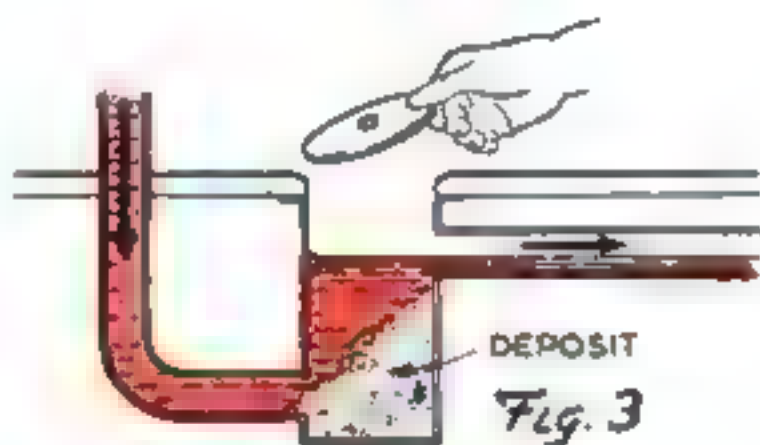
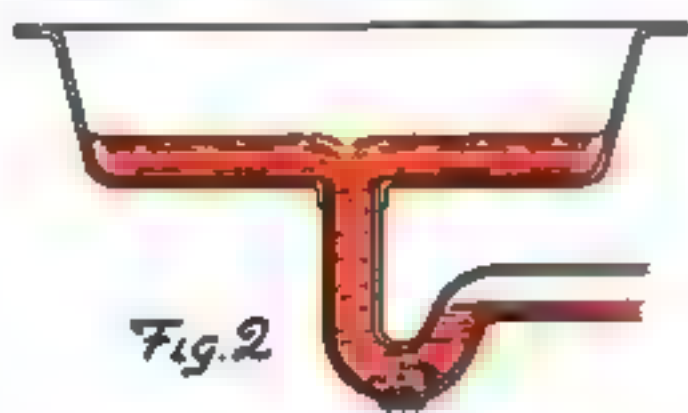
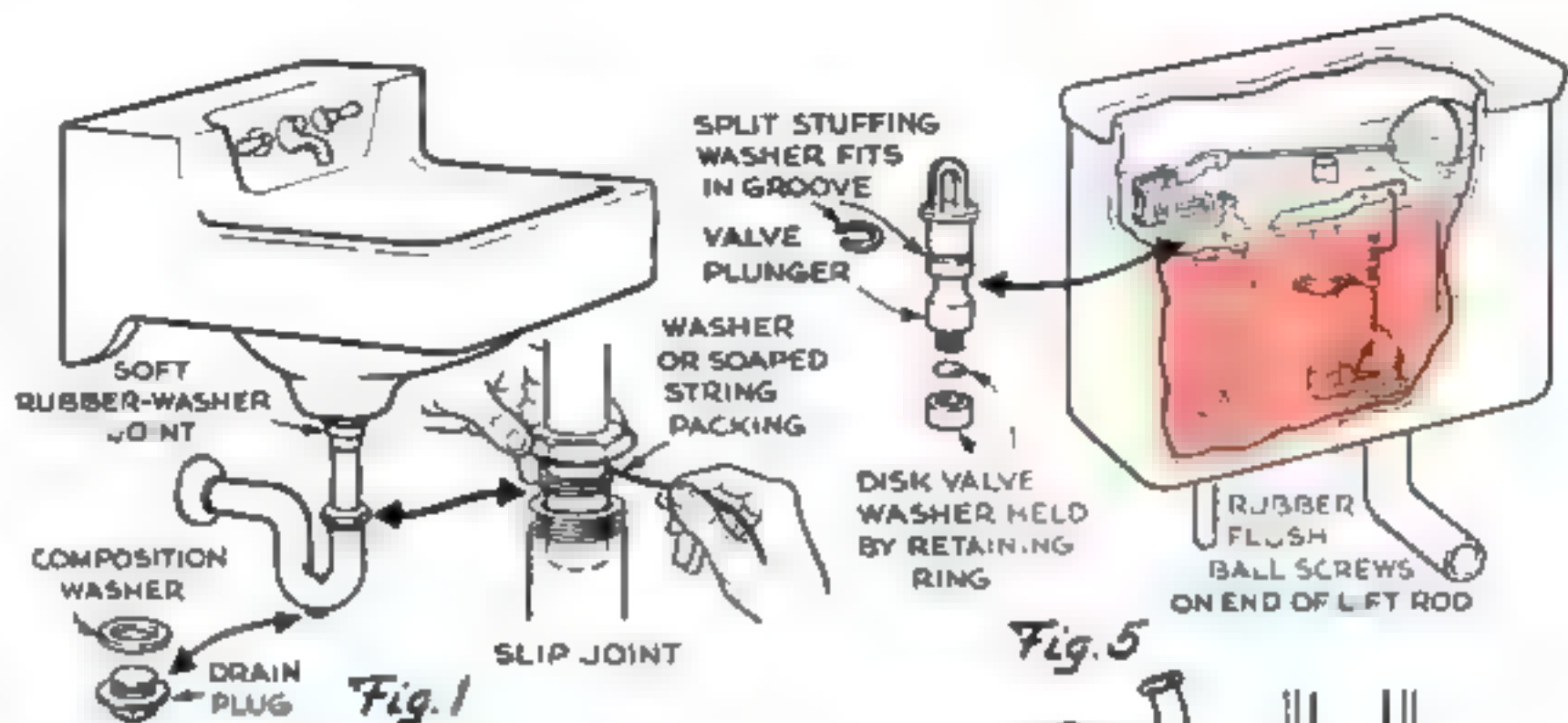
All lavatory and sink traps should be opened and cleaned regularly by unscrewing the drain plug (Figs. 1 and 2), which should be sufficient in ordinary cases. You will find two washer-sealed joints in a plated brass fixture of the type illustrated in Fig. 1. If you must disconnect the trap for any reason, do so at the slip joint, not at the soft-rubber washer joint just under the bowl. The slip joint can be easily reset and repacked, but the joint directly at the fixture is difficult to reset with the original washer.

In numerous instances a lavatory pop-up stopper that is out of adjustment will fail to permit quick draining, or it may leak. Readjustment of the coupling that joins the control rods will correct this.

Drum traps (Fig. 3), usually employed in bathtub drains, can be opened, when they are accessible, by unscrewing the top. They should be cleaned out with a spoon. If the trap should be behind a wall having no removable panel, it is important to clean the strainer in the tub often to prevent overloading.

A fixed quantity of water is required for the proper flushing of a toilet. This is re-

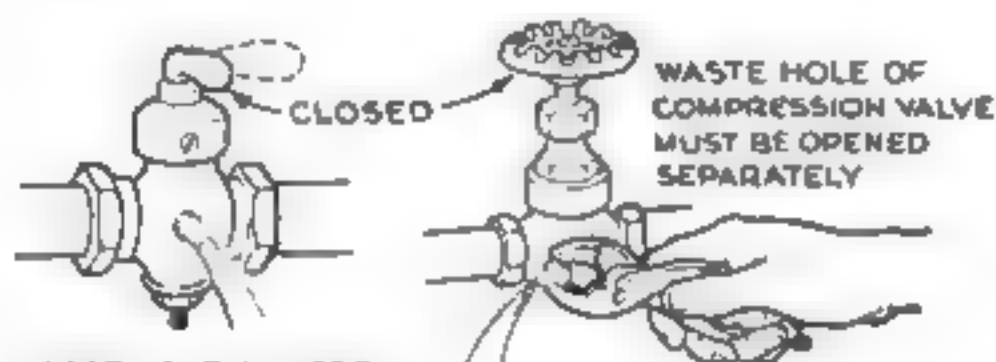
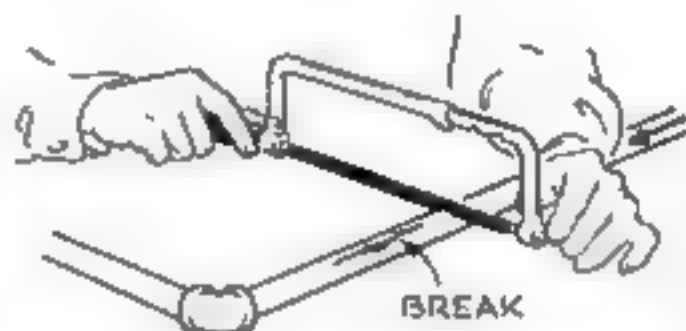
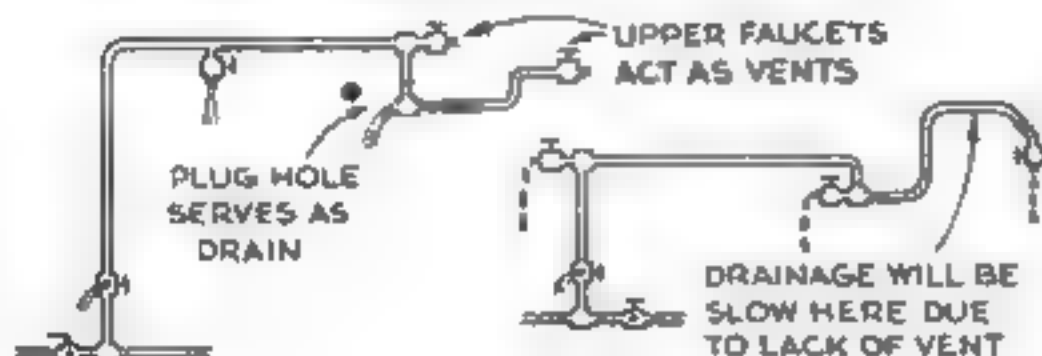
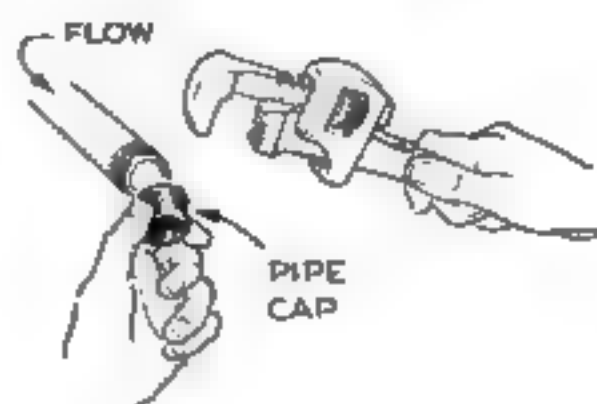
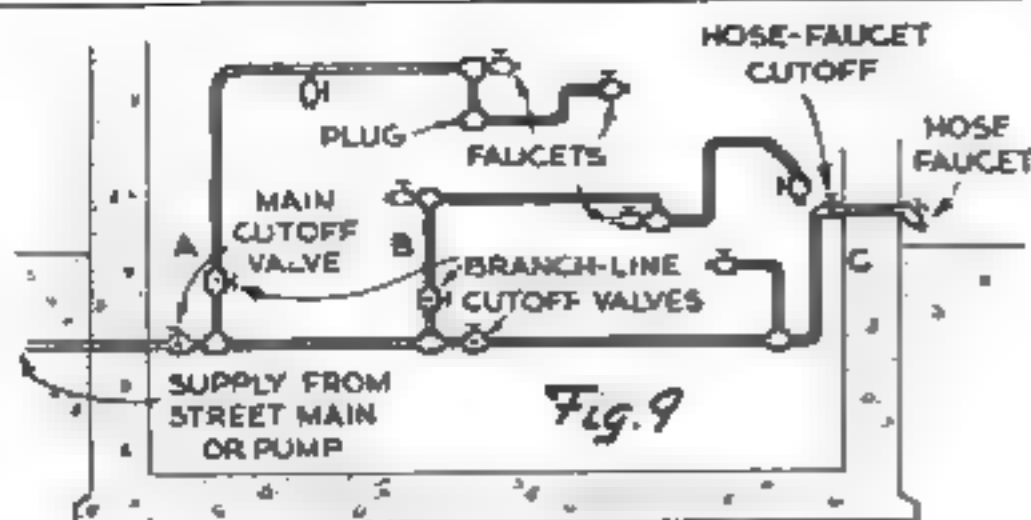




leased in a toilet of the flush tank type when the lever controlling the outlet valve is tripped. The tank is then automatically re-filled by the action of the float mechanism controlling the intake valve. If the float action fails to bring the water to the correct level, bend the float rod up or down as required to raise or lower the level.

There are two types of leaks that can be detected by the continuous sound of water running into the toilet bowl. Water escaping down the overflow tube indicates a leak in the intake valve, while that escaping from the outlet valve means a leak past the rubber flush ball. The latter condition is caused by the ball not seating properly and





WASTE HOLE OF STOP AND WASTE COCK OPENS AUTOMATICALLY WHEN COCK IS CLOSED

Fig. 10



Fig. 13

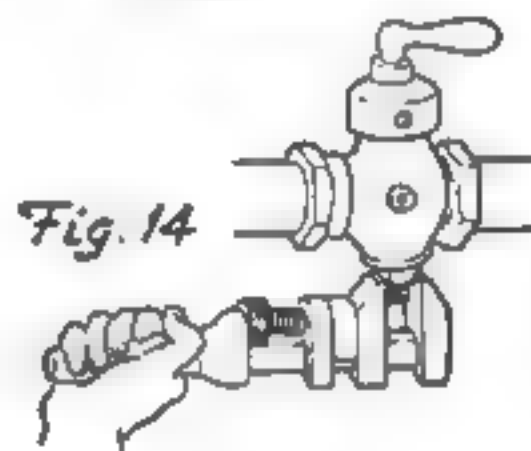


Fig. 14

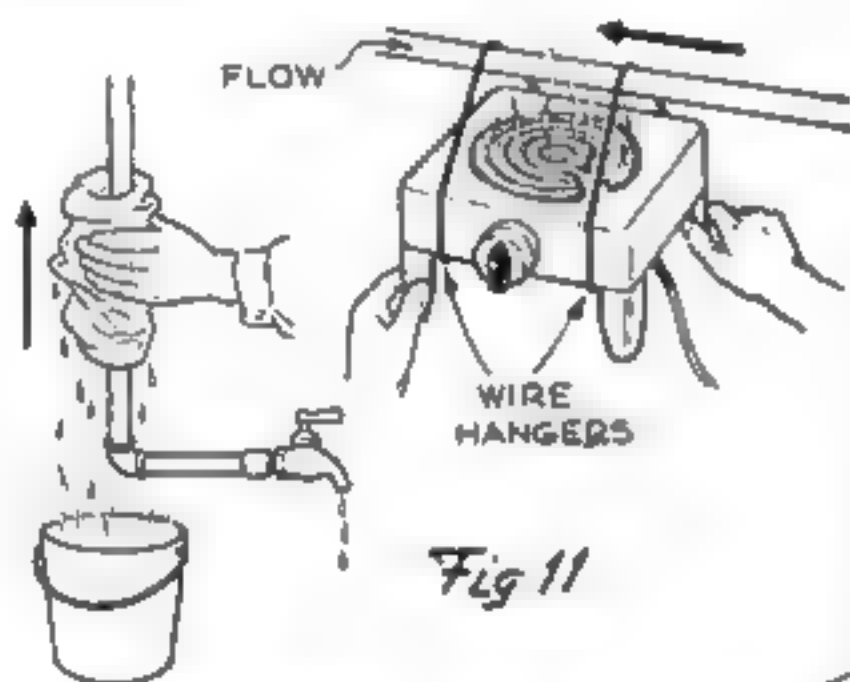


Fig. 11



Fig. 12

sometimes can be corrected by allowing more play where the lift rods are linked together (Fig. 4).

Worn valve washers and the ball can be replaced in a tank by following the directions in Fig. 5. A flush tank of the type illustrated contains a rubber flush ball, a rubber disk washer, and a leather stuffing

washer. The flush ball screws on the end of the lift rod and can be easily removed and replaced. To put in new washers, lift out the intake-valve plunger. The split leather washer fits in a groove, while the disk washer is held by a retaining ring.

A large rubber disk washer, instead of a rubber ball, is used on the outlet valve of





Regular cleaning of lavatory and sink traps prevents stoppages. When a fixture has a cutoff valve, as above, the house water supply need not be shut off

some flush tanks. It is screwed to the bottom of a metal float housed in a shell. When the washer is to be replaced, this shell must first be removed.

The packing in slip joints can be reached for replacement by simply unscrewing the friction ring, or collar nut. This is the same type of joint employed above lavatory and kitchen traps and shown in Fig. 1. A toilet-tank elbow has two of them.

If it is necessary to take up the toilet bowl, remove the flush tank first or you will be unable to disconnect the slip joints. Putty or a sponge-rubber gasket can be used for resetting the bowl on the floor flange, as shown in Fig. 6. Bolt the bowl securely to the flange, for if it remains loose, it may rock and leak at the floor joint. Putty, incidentally, can also be used for resetting the strainer in a sink.

Before most repair work can be done on the supply system, the water must be cut off and, in certain cases, the pipes must be drained. A typical run of supply piping is illustrated in Figs. 9 and 10, which show a simplified cold-water system and

its draining points. A hot-water system is similar except that its supply comes from the water heater. In the arrangement pictured, the branch lines can be cut off and drained independently, which makes it possible to do a repair job on any one of them without putting the others out of service. In draining a branch line, close the cutoff valve and open its waste hole; then open all faucets and other drains in the line.

How cutoff valves function as drains and vents is illustrated in Fig. 10. A vent must be opened at the upper end to allow air to enter and replace the water. If it is not, a partial vacuum is created. This holds the water suspended in the pipes until air entering at the drain can bubble up through the line. When a line is drained to prevent freezing, this situation can prove disastrous.

Supply piping is sometimes installed so that branch-line cutoff valves in the cellar can serve as drains while faucets on upstairs fixtures act as vents. In the system shown in Figs. 9 and 10, however, the condition existing in the branch line at A makes it necessary to remove the plug from the tee located at the drop in the line in order to drain this section. Because of the unvented gooseneck in the branch line at B, drainage of this section will be slow.

By hanging numbered tags on the cutoff valves and draining fittings, and listing them on a schedule giving their locations and the lines they control, you can save time when a repair is necessary. This will also guide anyone called upon to service or repair the plumbing in your absence.

When a common compression faucet

Tags on the cellar cutoff valves and a list of the lines they control will save time when an emergency repair has to be made







When access must be gained to the soil pipe leading to the sewer, the brass plug should be removed from the clean-out Y with a heavy wrench

(Fig. 7) drips, look for the trouble in the seat washer. To replace this washer, unscrew the cap nut, turn the stem until you can lift it out, and remove the brass retaining screw holding the washer. If this screw is badly corroded, it also should be replaced. Never force a new screw if it begins to turn hard before it seats the washer, as the threads in the stem hole may be corroded and may cause the screw to twist off. Clean out the threads with a tap of the proper size, or shorten the screw by filing off the end just enough to allow it to be turned down tightly and to seat the washer.

To stop a faucet from leaking around the stem, try tightening the cap nut. If this doesn't work, replace the stem washer. This may be done without cutting off the water pressure. Simply remove the handle, unscrew the cap nut, and lift it off the stem. The seat washer keeps the water from flowing.

A compression cutoff valve is fitted with stem packing in addition to a stem washer, as shown in Fig. 8. Packing in good condition requires little pressure from the packing nut to make a watertight joint. Put in new packing when the old one is so compressed that the packing nut must be turned down hard to stop a leak.

Sometimes a leak in a stop-and-waste cock can be halted by tightening the nut at the bottom of the valve, as in Fig. 14. Tighten it just enough to stop the leak without binding the valve so that it will not turn.

Attention to these details in your periodic check can prevent serious trouble. However, should a hard accumulation be caught in the pipe beyond the trap, snag it and pull it out. Short coil-spring augurs having a hooked end are made for this purpose. Some are equipped with a crank handle, which

should be turned clockwise both while feeding the augur in and while withdrawing it.

Flat spring-steel sewer rods are available in various lengths suitable for working in the soil pipe leading to the sewer, access to which can be gained through the clean-out Y shown in Fig. 12. A length of armored electric cable, with one end of the metallic sheathing unwound slightly to form a hook, can sometimes be used successfully. The clean-out Y can also serve as an emergency outlet for that part of the waste system above it should a stop-

page in the soil pipe be too difficult for you to remove.

During extremely cold weather, it is, of course, wise to take some precautions against the freezing of plumbing that is not fully protected. Open windows in a bathroom or kitchen are a danger to fittings and exposed pipes that stand close by. Cellar doors, especially cellar garage doors, should close tight. In partially heated quarters, it is advisable to let a faucet drip during very cold nights in order to keep the water moving in the pipe. Hanging a light bulb against a vulnerable pipe or fitting will also prevent freezing in some cases. If a house is to be closed with the heat shut off during cold weather, all pipes should be drained, and it is wise also to put a little antifreeze in traps that are hard to reach.

In thawing a frozen pipe, start heating at the faucet end and work toward the main supply line, as in Fig. 11. Leave the faucet open to permit the thawed section to drain, and keep the pressure on to assist in breaking up the ice once it becomes slushy. As a precaution against fire and to avoid the possibility of bursting the pipe with sudden, intense heat, apply only slow-heating methods, such as hot bricks, towels soaked in hot water, and electric heaters. If a blow torch must be used to speed up a job, play the flame back and forth to spread the heat.

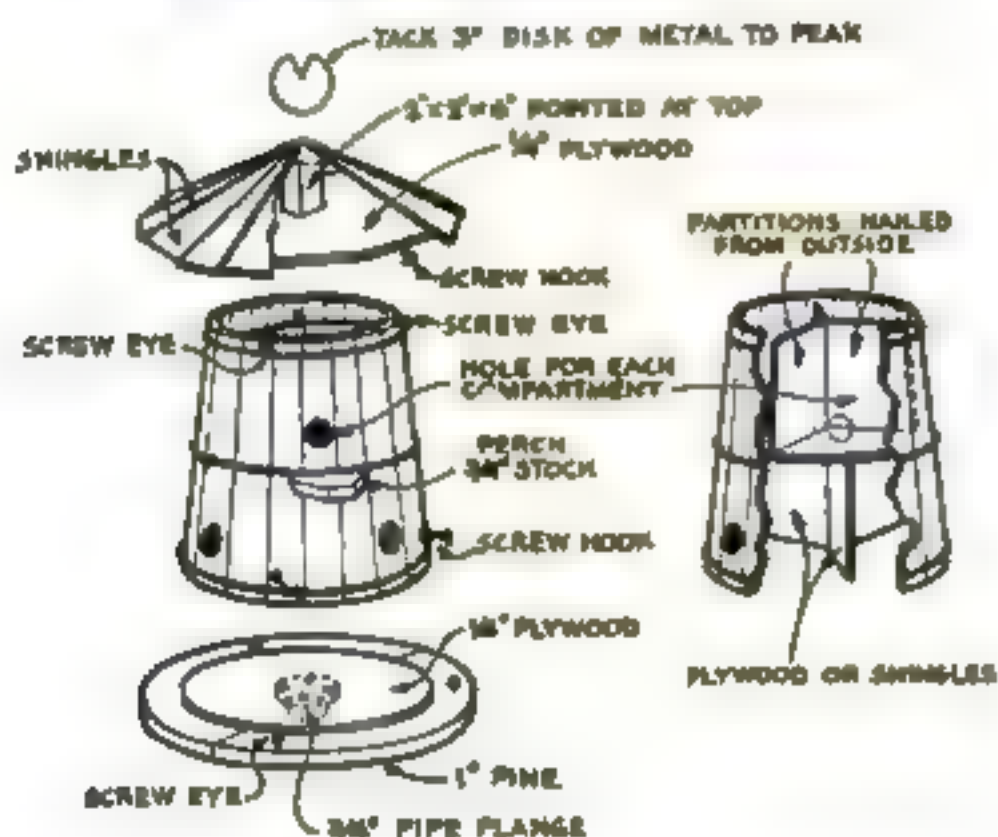
Should a leak occur, an emergency repair can be made with a coating of roofing cement or calking compound. Bind it with friction tape or a section of garden hose held securely with hose clamps. A damaged pipe line may be put into temporary use, as in Fig. 13, by removing the broken fitting back to an accessible threaded joint and screwing on a pipe cap, or by sawing off the pipe above the break and plugging it.



## Penthouse Made from Pail Lures Aerial Tenants



BY KNOCKING the bottom out of an old wooden bucket, you can easily make a cozy penthouse to lure avian house hunters. Into the bucket, fit a disk of  $\frac{1}{4}$ " plywood halfway down. Partition the upper and lower stories into three compartments each, arranging them so that none of the entrances, which are bored through the bucket, is above another. Leave a 1" space between the partitions and the top and bottom of the bucket. A circular base 6" larger than the big diameter of the bucket is made from 1" pine.



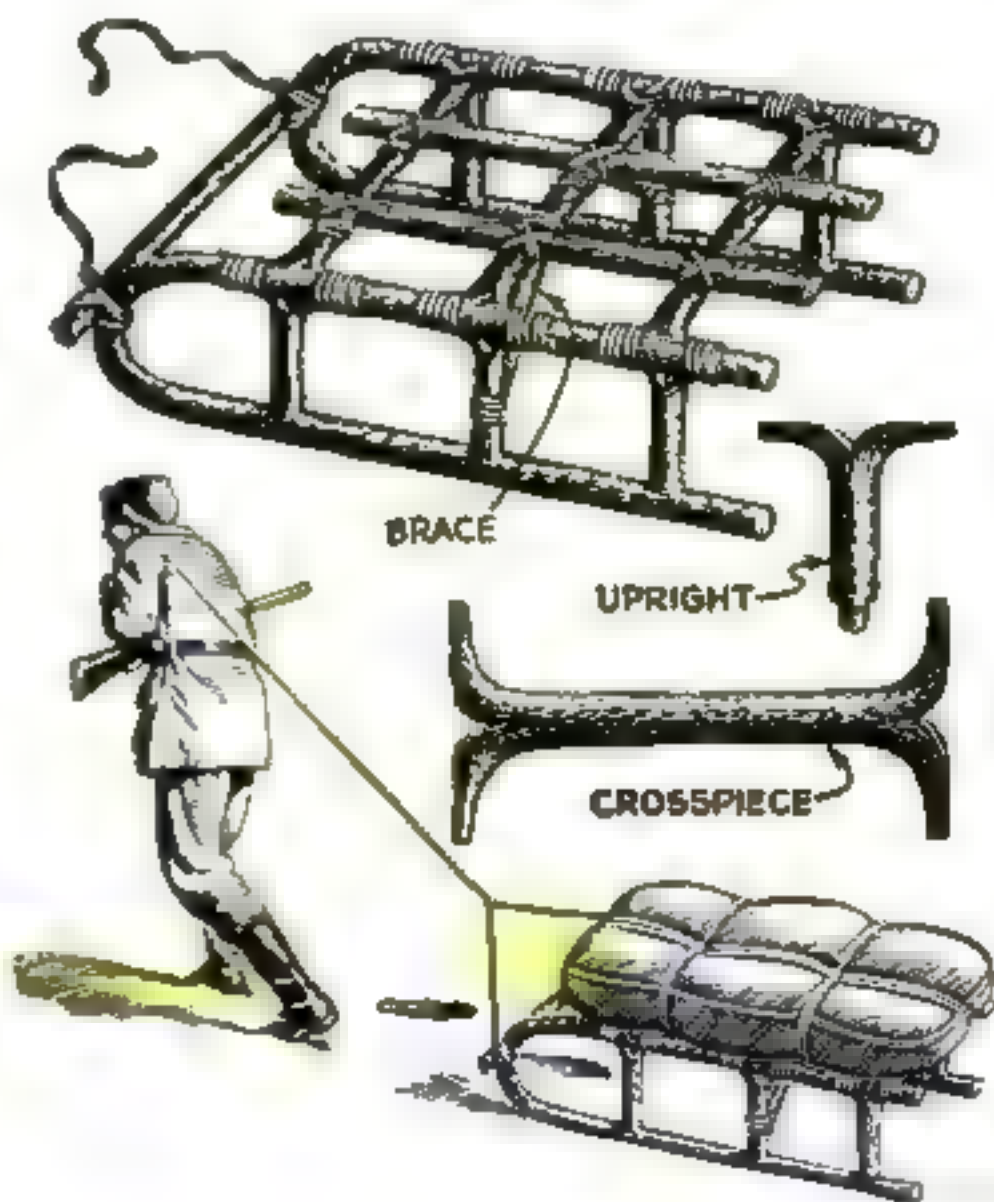
Make the ceiling a decagon of the same diameter as the circular base. Fasten to it a 2" by 2" by 6" block with a cone-shaped upper end; then attach a double layer of wedge-shaped shingles. Cover the peak with tin to shed rain. Screw eyes and hooks hold the bucket to both the roof assembly and the base so that the house can be taken apart for cleaning.

To set the house on top of a threaded pipe, screw a  $\frac{1}{4}$ " pipe flange to the bottom of the base. If it is to be suspended, put a heavy screw eye through the tin peak into solid wood and daub roofing cement around the screw-eye shank.—J. A. EMMETT.

## Forest Supplies Materials for This Indian Emergency Sled

A CHIPPEWA Indian sled may prove a lifesaver in case of injury to a companion along a rugged trail. Ash is the best wood to use since it will bend without breaking when green. Form the runners from two branches and bore six holes in them for the uprights, which are cut and shaped to fit the holes after being partly split at the top. Install the rear uprights first, thus binding the runners in shape and making it easier to set in and fasten the forward uprights.

Lash the front spreader in place. Form three crosspieces, as shown in the drawing, and lash them together with the other members of the sled. Finally, lash two straight sticks lengthwise on top of the crosspieces. If no cord or hide is available, bark strips from ironwood or laces pulled from the boots of the injured man can be used as thongs.—GRAY WOLF







# New Home Movies For Old

## HOW TO EDIT YOUR FORGOTTEN FILMS TO GET ADDED ENJOYMENT

By CHARLES CLARKE, A.S.C.

**W**ITH many a maker of home movies, the completed films are the Cinderella of his hobby. His camera and projector are treated like the precision instruments they are, but his films are just tossed into cans and left to fend for themselves between showings.

Such photographers often seem to forget that the films are the end for which they have labored, whereas the equipment is merely the means. They must be handled as carefully as the camera and projector themselves, and they must be kept just as

clean. If they are, you and your friends will derive increased pleasure from them, and you will be able to keep that enjoyment alive for a much longer time.

It is really an easy matter to keep films showing perfectly for years, if you only know the rules—the few simple ones employed at the professional studios in Hollywood. They sum up to keeping clean those parts of your camera and projector that touch the film in the making and in the showing, and to keeping the film itself clean. The result is that dirt, oil, and other foreign substances will not scratch or cloud the frames.

You want to be sure, first of all, that the camera lens is clear and clean for every shot. Wipe off dust particles, moisture, and fingerprints, preferably using a soft brush. While such accumulations may not actually injure the glass, their presence will diminish the clarity of your pictures. If the lens can be removed, also clean the rear element. The gate must be cleaned as well; otherwise bits of emulsion that collect there may scratch the film or cast shadow images.

Any approved cleaner will remove from the developed film the inevitable dust, fingerprints, and bits of cement that come with editing and titling. These particles, if allowed to remain, will eventually find their way into your projector and leave

Dividing his interest between Twentieth Century-Fox studios and his home laboratory, Charles Clarke has made more home movies than professional ones, and he brings you experience gained in both roles. He worked as chief cameraman on such recent films as "Careful, Soft Shoulders," "Moontide," and the technicolor musical "Hello, Frisco, Hello."





streaks of black on the emulsion. Draw the film slowly through a cloth that has been dipped into the cleaning fluid and wrung out to remove the excess. This may be done on a rewind device with the cloth held near the first reel. Wind slowly so the cleaning fluid will evaporate before the film reaches the rewind reel.

After it has been cleaned, the film should be stored on a large rustproof reel, not on a small reel of the type used by processing laboratories in returning film to their customers. Storage space can be conserved by splicing several sequences together for winding on the same reel. Place each filled reel in a suitable film can that will close out all light, and keep it in a closet or a bookcase where the film will remain cool, dark, and dry and stay pliable. Should film become brittle, however, it can sometimes be restored by being put in a covered bowl with a moist sponge, but do not let it touch the sponge.

Color film needs even more careful treatment because of the additional danger of its colors fading. In fact, the makers of this type of film warn that the normal color balance can be best retained when the film is stored in a cool, dry place—at a temperature of no more than 70 deg. and a humidity of less than 50 per cent.

No matter what precautions you take, your sequences will eventually begin to show signs of wear, but don't throw them away. Spend an evening reviewing the older pictures, select the scenes you would like to preserve, splice them together, wind them on a large reel, and send them to a film laboratory for duplicating. When they are returned, store the originals in a safe place and use the duplicates for projection.

Most amateur camera-

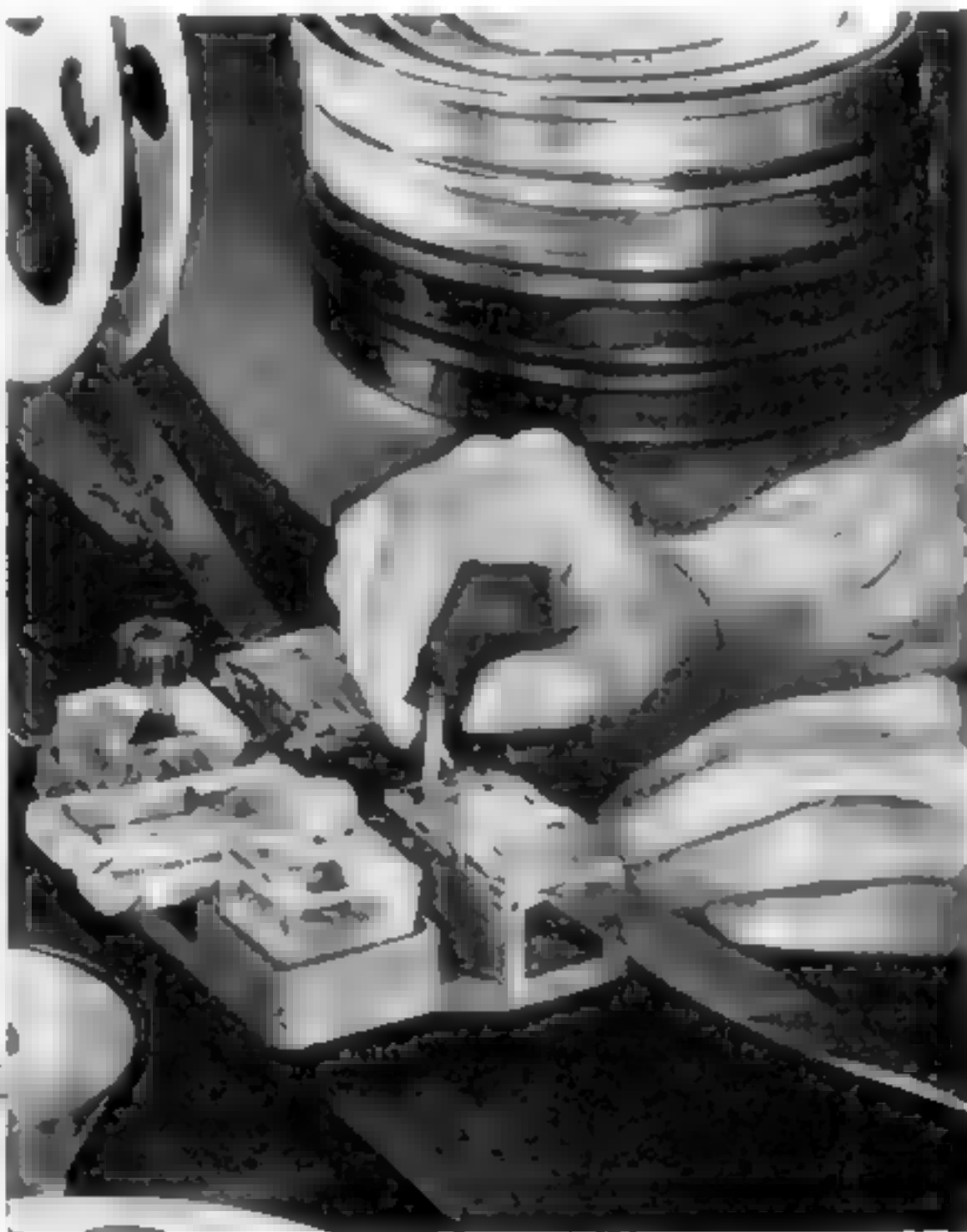
After cuts have been made, trim the ends of the good film, take off the emulsion with water and scraping, and splice with cement

men have considerable good footage from past years that requires hardly more than a little judicious editing to be put into shape for interesting showing. Unrelated scenes may have been spliced together haphazardly with the thought that some day they might be edited and titled. Why not do this job now? By using only the better scenes and a few appropriate titles, you can create, during one or two evening sessions, reels that will provide many evenings of pleasure.

Think of the picture to be edited as you would of a story you wish to tell in an orderly and attractive way. Employ only interesting episodes and weave them into a logical sequence.

First, assemble the equipment you will use: movie viewer, rewind and splicing block, projector, screen, paper, pencil, and the film to be reviewed. Set up the projector and screen, and run the reel through. Just watch the screen this first time, taking no more than mental notes of the interesting episodes and the quality of the film. Then rewind the reel and run it through again, taking notes with a pencil.

Suppose the picture carries the family







Scene-by-scene notes jotted on a pad as the film is projected will be a big help when it comes to making cuts later on the viewer

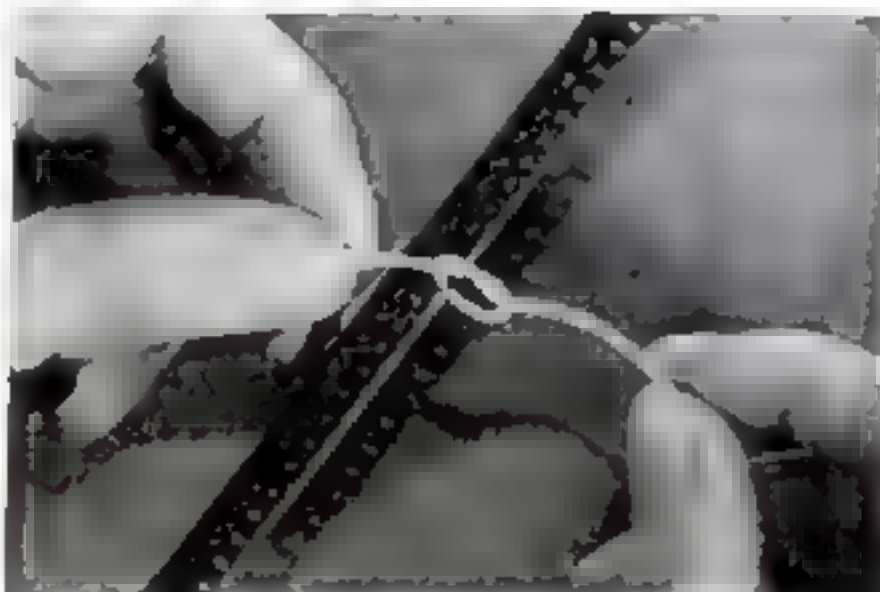
Sections of film to be cut may be identified with grips in the edge of frames, as shown in the first photo below. Points for inserting titles can be marked with tape or string

through a back-yard party. Your notes will unfold something like this: "Children waiting on back porch . . . cut delay before they race to barbecue. Little Bobby walks out side door carrying toy sailboat . . . scene too long. Jim cooking meat . . . O.K. Mother and sister setting table . . . good, but cut first part, underexposed. Janet serving meat . . . excellent. Father eating . . . good. Henry and sister struggling with large sandwiches . . . good, but cut where camera jiggled."

With these notes at your elbow, rewind the film and start it through the viewer. You want to eliminate some of the delay on the back porch. Wind the film slowly through the viewer until you reach the point for the cut; then press the lever at the gate and snip an identifying mark on the edge of the film. Continue winding until you reach the end of the undesirable section, and snip the edge of the film there.

Before going further with the viewing, tear out the undesirable footage and splice the good film. This will save time in the end and be assurance against mistakes that are likely to be made in helter-skelter reviewing of an entire reel and an attempt to remember all the cuts.

In splicing, place the torn ends of the good film on the splicing-block pins and swing the shearing arm down, trimming both evenly. Touch a moistened brush to the ends to loosen the emulsion, and then draw a scraper across the edge to remove it. Spread cement over the cleaned edge with a brush, swing the lever controlling the end of one good section of film, moving it firmly down over the other, and pressure plus cement will complete the splice.





The rest of the job is largely repetition of this first step. Where the viewer reveals sections that should be removed, mark them with identifying snips and remove them, continuing until you have reached the end of the reel.

Sometimes a rearrangement of scenes will produce greater interest—a mixture of comedy and straight shots is often very effective. Don't hesitate to make whatever changes you think will be an improvement. It's the total effect that you want, and your changes should be made with that in mind.

Don't close the sequence with an underexposed scene taken in late afternoon. It always adds a sour note to what otherwise is an enjoyable record. Why not splice in a beautiful sunset from some vacation footage for the conclusion?

Determining where to put in titles depends to a large extent upon your personal desires and the nature of your picture. In general, the fewer the titles, the better. They should not be too wordy, and you should give them enough time to be read easily. Titles are useful to explain shifts in scene or to indicate a passage of time, but opening scenes often serve adequately to label all those that follow. Two or three shots of meat being taken from the refrigerator, moving down the driveway on a platter, and sizzling over the fire set the stage for a barbecue.

All of us are familiar with the "conversational titles," and they often work better than the conventional printed ones. "We'd like to show you a picture of the family

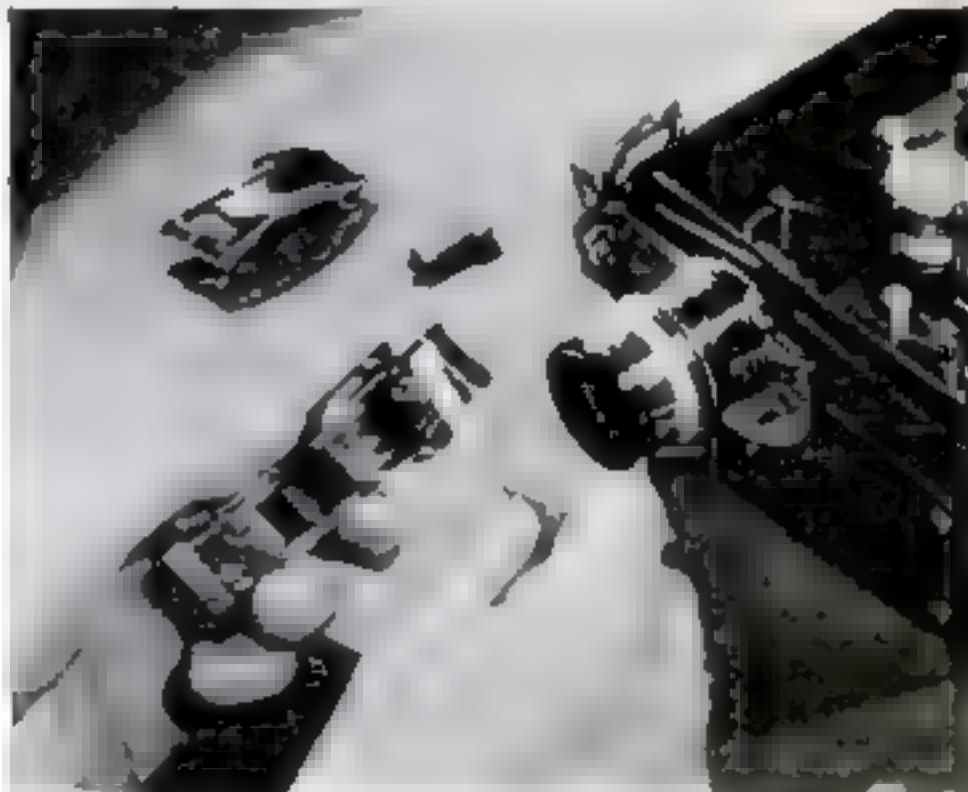
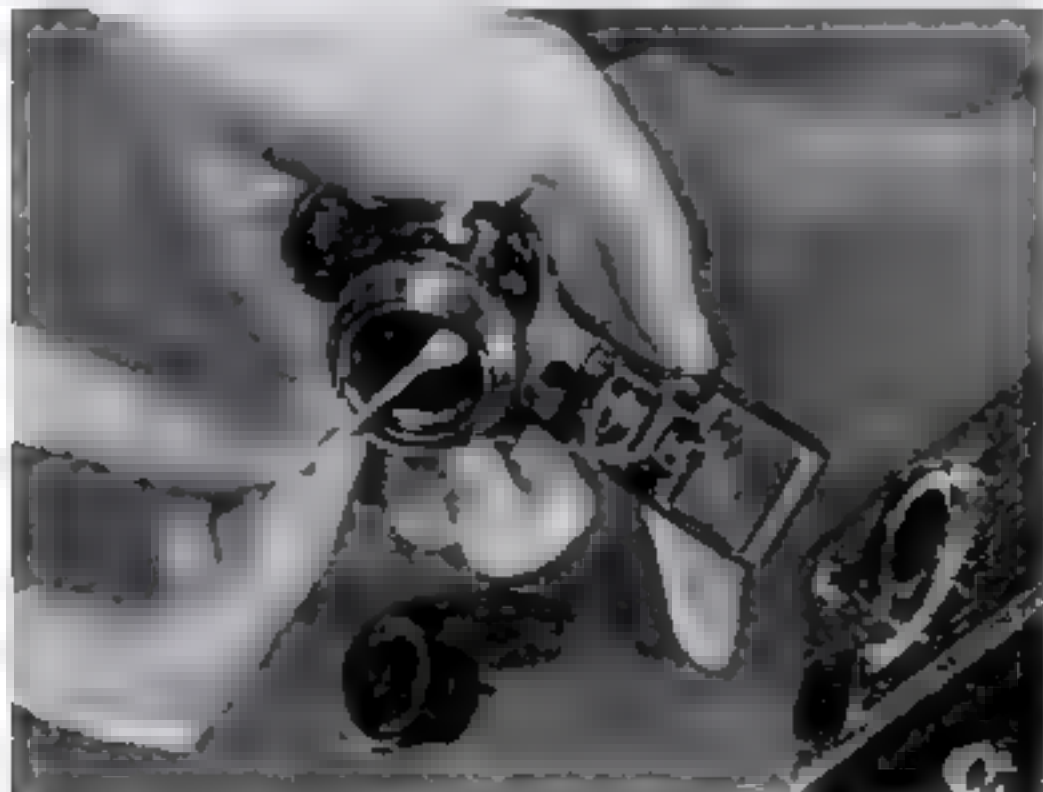
enjoying a barbecue." That covers the story we have outlined better than a dozen eye-jarring interjections, no matter how tricky or professional you make them. If you wish to insert titles, however, mark the places on your film with pieces of string or tape and splice them in.

The next step is to show your sequence. Check over your projector to be sure it will be presented with the maximum effect. Only good, clean lamps should be used, for blackened ones will cause loss of brilliance on the screen. Go over both surfaces of the projection lens and the reflectors with a clean, soft cloth, removing any smudges that may have collected. Wipe oil and bits of emulsion from the film track to keep them from scratching or clouding the film. If the projector is equipped with a rheostat, set the lever for minimum illumination and let the machine warm up.

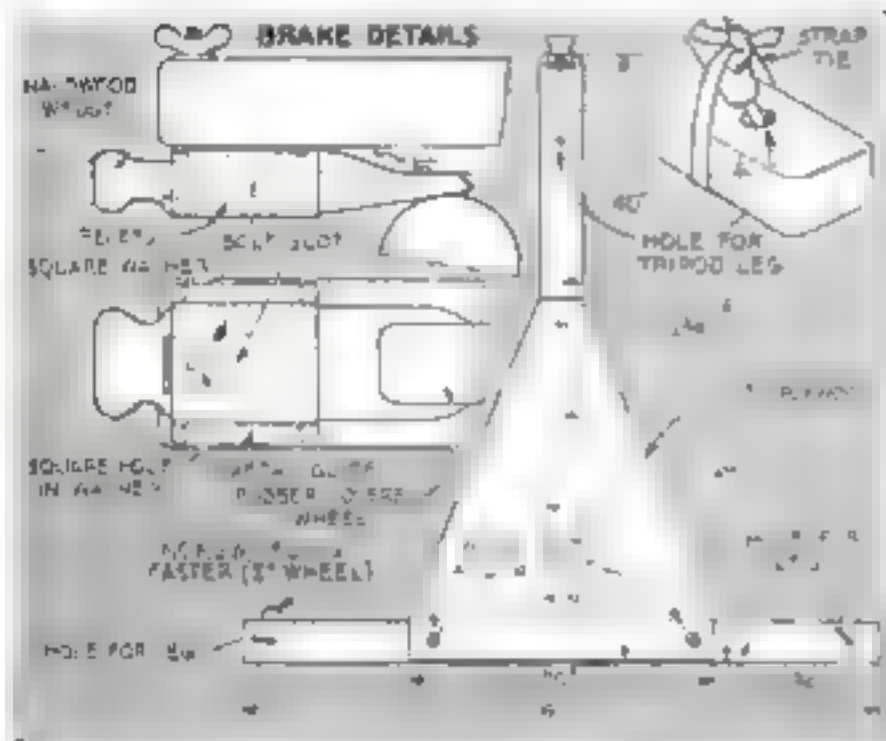
You will, of course, not forget to thread the film in the track with loops of the size called for in the manual, otherwise strain on the film will cause it to wear. Follow the manufacturer's recommendations also when it comes to brilliance of screen illumination, for too little light will cause underexposure and too much will wash out the images.

It is important to have a good screen. A large sheet of dull white paper, or even a large white blotter, will serve; but whatever screen you use should not permit light to leak through, for all that passes in this manner is lost to the audience, and extra power in your lamp will result only in that much variance from correct exposure.

Care of the camera lens is the first step in care of film. Wipe dust, moisture, and fingerprints from the lens so the film will be clear. If the lens is removable, clean the gate at intervals, as at right





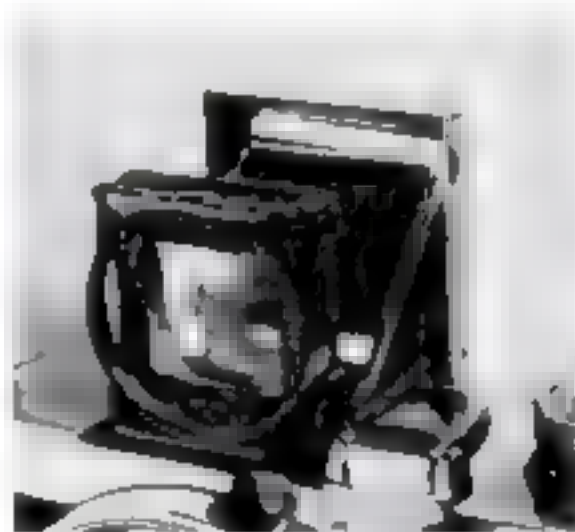


**A TRIPOD TRUCK** which is equipped with a brake to keep it from rolling at inopportune moments is a real aid to amateur movie makers. The truck shown at the right can be made with little difficulty, and it will afford the photographer full freedom in locating the camera just where he wants it. Once in place, the truck can be locked securely by a wedge brake on one caster. The tripod legs rest in holes near the ends of the T-shaped frame. Nonswivelling casters with 2" wheels



are fitted to the cross piece, while a swivel caster is attached beneath the front of the truck. Strap ties hold the tripod legs firmly in their sockets.—CLARENCE N. ALDRICH.

**WAIST-LEVEL FINDERS** are particularly useful in candid photography and in making angle shots. If your camera has only an eye-level finder, it can easily be converted for double duty. Cut from a small mirror a rectangular section which will fit at a 45-deg. angle between the front and rear elements of the finder. Although the image at waist level will be inverted, it will not be transposed, and hence there is no difficulty in following moving objects. Since the field is narrowed by the greater distance between eye and finder, correct this by putting a negative (reducing) lens, of about 70-mm. focal length, in front of the finder. Photo tape around this lens serves as a detachable fitting.—ROBERT SCOTT.



**HEAVY BOOK ENDS** are handy bases on which to attach spring-clamp reflectors for table-top pictures. Being easily moved, they allow the photographer more scope in arranging the desired lighting than do the chair backs or other objects on which such lamps are usually clamped. Place the lamp so that its center of gravity is on the same side as the foot of the book end.—WILLIAM SWALLOW.

**THE LIFE OF PHOTOFLOODS** can be increased by using them only during actual shooting, and not while placing and aiming the lights and focusing the camera. If you do not have a dim-bright switch, use ordinary light bulbs in your reflectors while making these preparations. Put 50-watt bulbs where you will use No. 1 photofloods, and 100-watt bulbs in place of No. 2 photofloods. Substitute the photofloods when ready to shoot.—DONALD A. SIGMAN.



**TESTING AN EXPOSURE METER** suspected of inaccuracy may be done without a standardized photocell. Guided by the sheet of instructions packed with film, duplicate the exposure conditions called for, and then see if your meter indicates the same settings. For example, suppose a certain film specifies

f/6.3 and 1/25 second with two No. 1 photo-floods 6' from the subject. If your meter calls for a substantially different exposure, it is probably in error. The upper end of the scale may be tested outdoors in bright sunlight, but avoid doubtful conditions such as "hazy sun" or "light clouds."—J. W. C.

## FOR CAMERA USERS

**SHORTAGES** of new photographic equipment for civilians are best explained by scenes such as that on the right, showing a combat photographer during the battle for Rendova in the Solomons. Here a 16-mm. magazine-loading movie camera takes telephoto shots of jungle tactics instead of filming some amateur's vacation.



**LENS CEMENT**, needed to hold together the components of highly corrected lenses, must possess both transparency and resistance to discoloration. Shown above are the seven components of an aerial camera lens, plus a small bottle of a new cement now used in Army Air Forces lenses. It was developed after combat experience—which may involve 150-deg. temperature changes in a few minutes—showed that previous adhesives might break up. This cement withstands desert-to-stratosphere contrasts,



**AN IMMERSION HEATER**, shown below, is needed by military cameramen at arctic bases to keep solutions usable in 50-below weather. The differing conditions which service photographic equipment must undergo are indicated by this and by the picture above.





# AMPLIFIERS... Magic

HOW CIRCUITS ARE DESIGNED TO RESPOND TO FREQUENCIES RANGING FROM A FEW TO MILLIONS OF CYCLES PER SECOND

IN THE days when loudspeakers resembled Grandpa's ear trumpet, audio-frequency amplifiers, proudly wired with right-angled bus bars, were built around what looked like miniature power-line transformers. Today, amplifiers are almost all resistance-coupled. What happened to the transformers?

Theoretically, transformer coupling has many advantages over resistance-capacitance coupling. But theory involves the use of an ideal transformer—without core losses, winding losses, or resonance peaks—which remains nonexistent because there is no such thing as a pure inductance.

Because the magnetic field surrounding each turn of wire in a coil sets up a counter E.M.F. in adjacent turns, an impressed A.C. voltage results in a voltage difference between any two turns as well as across the entire winding. At extremely high radio frequencies, this may amount to hundreds

of volts. But two adjacent conductors at different potentials constitute a condenser, so our inductance coil is also a capacitance. The wire winding, like other conductors, also has a certain resistance.

In electronics, these factors weigh heavily and were largely responsible for the abandonment of transformer coupling, for in audio-frequency transformers, the inevitable capacitance effects act with the inductance of the windings to produce resonance peaks within or near the audio-frequency range of between 15 and 15,000 cycles per second. By careful design, these resonance peaks can be shifted out of this range, but the linear-response transformers so built are high-priced precision instruments.

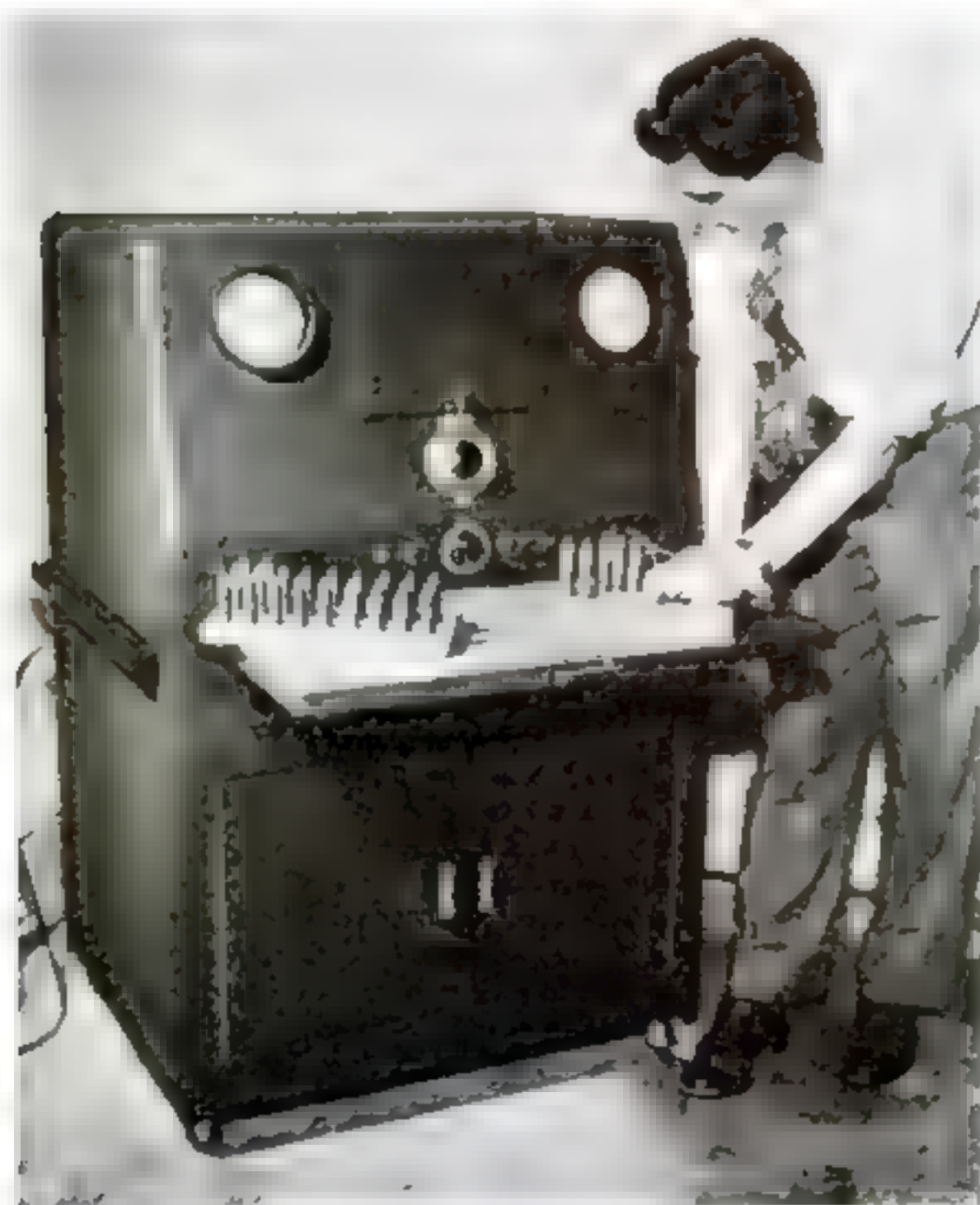
Another reason for discarding transformers is more complex. The maximum gain is obtained from a given tube when the load resistance is about the same as the plate

resistance of the tube. Modern pentodes have a plate resistance of several hundred thousand to a million ohms or more. While it is impractical to make a million-ohm transformer winding, a million-ohm resistance is easy to make and correspondingly cheap.

Another advantage is that a complete resistance-capacitance coupling takes less space than even the mounting bracket for a transformer. Furthermore, resistors and condensers are unaffected by near-by power transformers, which may cause hums in audio coupling transformers.

For all these reasons the iron-core transformer is limited to push-pull driver circuits and the output

Metals are checked, evaluated, and even sorted by the Du Mont Cyclograph. Instruments like this usually employ broad-band-pass amplifiers which, if used in a radio, would amplify all frequencies at the same time





# Levers of Electronics

By

JOHN W. CAMPBELL, JR.

circuit of resistance-coupled amplifiers. Radio-frequency amplifiers, however, make good use of another kind of transformer—the air-core type—by taking advantage of its tendency to tune to certain resonance frequencies. Figure 1 shows a standard radio-frequency circuit. A single such unit may feed a superheterodyne circuit, or three may be combined into a tuned-radio-frequency (T.R.F.) set.

Only the secondaries of the transformers are tuned. The adjustable condensers are usually both on the same shaft, or ganged. They are shown in the diagram by a symbol with a curved arrow representing the movable plates.

Transformers with both a tuned primary and secondary are more selective and give greater gain. Figure 2 shows how they are used in a superheterodyne hookup. An incoming signal is first converted to a predetermined intermediate-frequency (I.F.) signal, and the I.F. transformers are tuned once to this frequency when the set is assembled. The tuning condensers (trimming condensers) are represented by the conventional condenser symbol with an arrow through it. In practice, they are usually built into the metal housing or shield surrounding the transformer, with only the heads of the adjusting screws accessible, and are tuned with a screwdriver. If left unshielded, such transformers would pick up hum from a power transformer, or one coil could affect another.

The response range of transformer-coupled amplifiers is thus governed by resonance effects due to inductance and capacitance, and it is these that enable us to tune R.F. circuits so that they will respond only to the frequency of the signal desired. With A.F. amplifiers, the problem is just the opposite. Voice and music frequencies

range from 15 to 10,000 cycles. If an audio-frequency amplifier responded only to frequencies of 200 to 2,000 cycles, both low and high notes would be lost. Then what governs the response range of a standard resistance-coupled circuit such as that shown in Fig. 3?

Since D.C. will not pass through the coupling condenser  $C_2$ , it is plain that the circuit will not amplify D.C. By definition, one cycle per second is A.C., but the circuit will not pass that either. There is a lower limit to the frequency  $C_2$  will pass, and this depends upon its value and that of the

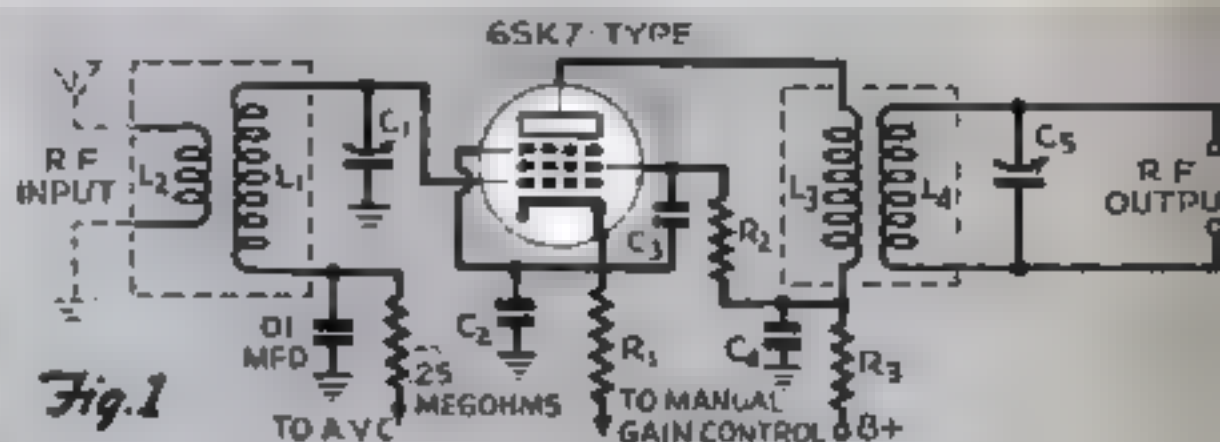


Fig. 1

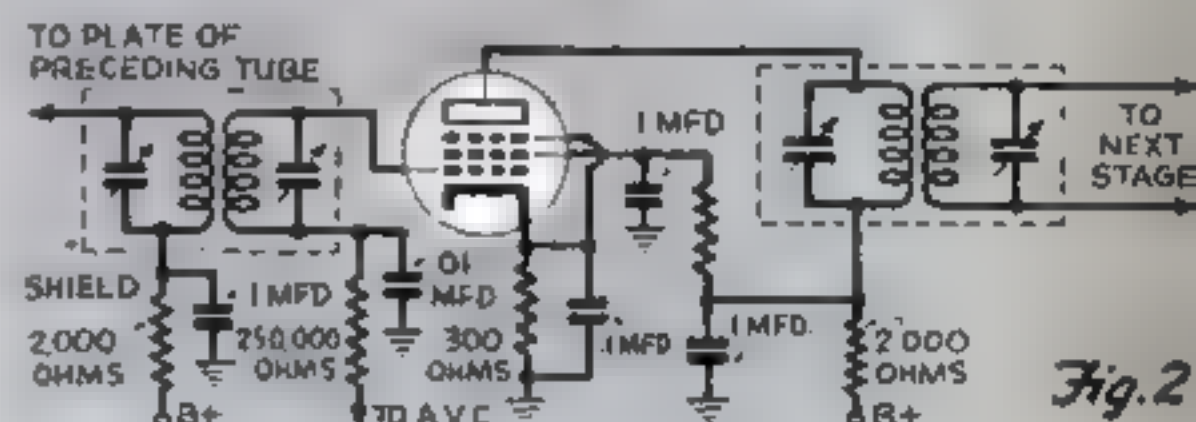


Fig. 2

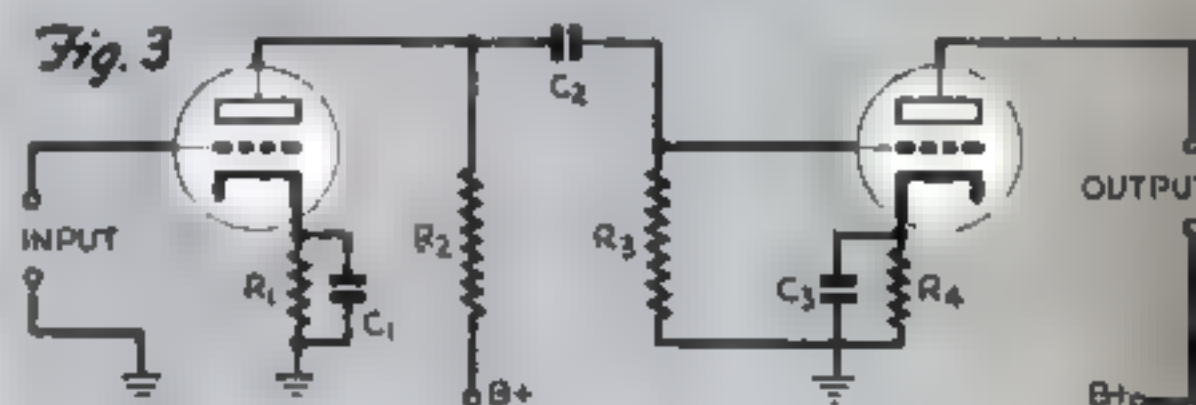


Fig. 3

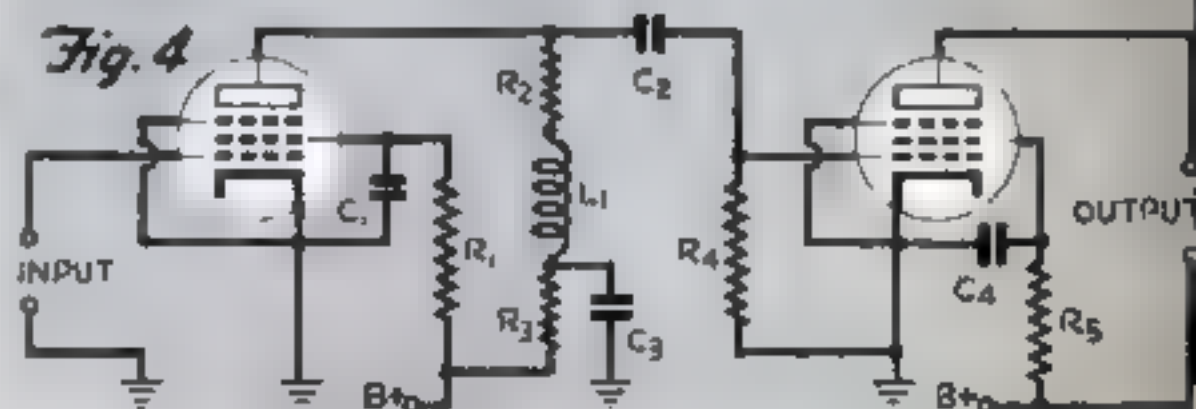


Fig. 4



resistor R3. If R3 drains the charge off C2 as fast as, or faster than, it accumulates, no signal will pass to the grid of the second tube. For frequencies down to 100 cycles, with a 500,000-ohm value for R3, C2 may be .01 mfd. For a high-fidelity amplifier sensitive to frequencies as low as 15 cycles, C2 would have to be of .1-mfd. capacity or more.

Response to high frequencies is limited by another factor—losses from wiring and tube capacitance. The tube sockets, resistances, and condensers are mounted on a metal chassis. But any two conductors separated by insulation constitute a condenser. Thus there is capacitance between the wiring of the amplifier and the chassis. Since this is only about 30 mmfd., it is negligible at low frequencies. But a condenser offers less resistance to A.C. as the frequency of the current increases. At 1,000,000 cycles, capacitance losses can be appreciable.

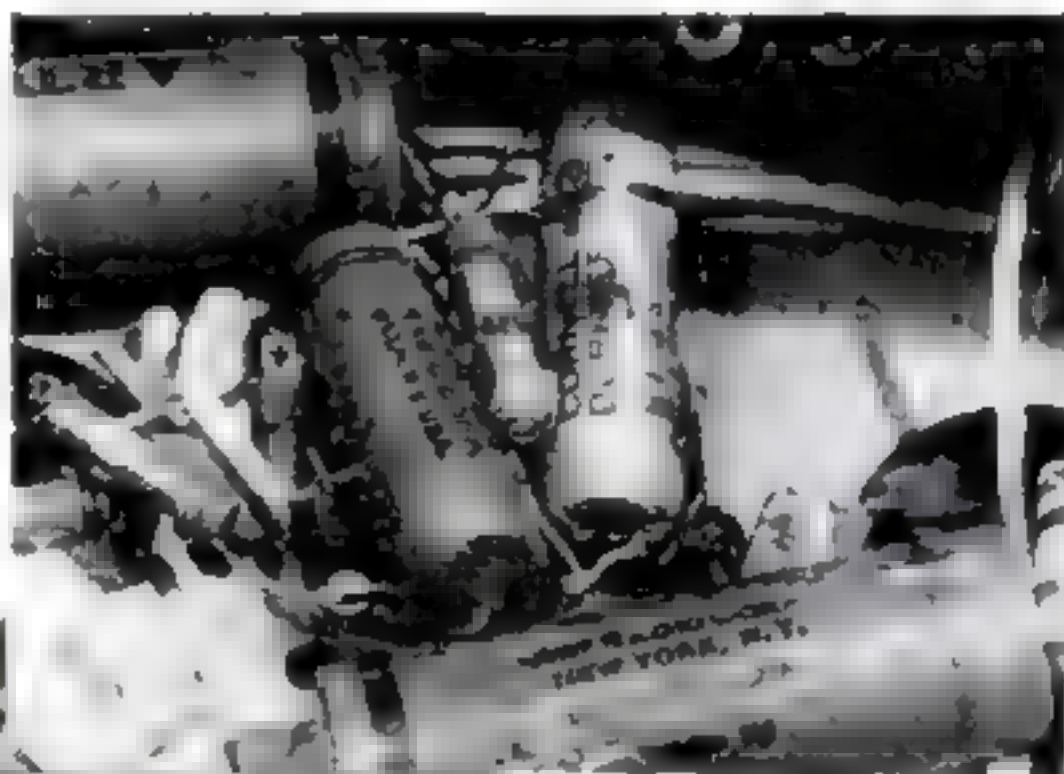
In radios this effect is nullified by using this wiring capacitance as part of the tuning capacitance of the tuned-transformer coupling. One side of each secondary and tuning condenser is grounded to the chassis. The trick can't be used with a television video (picture-image) amplifier, which must faithfully amplify all frequencies from 30 to 4,000,000 cycles. This problem is solved by the hookup shown in Fig. 4.

The load resistance, instead of being a resistor, consists of a resistor and an inductance in series. To A.C., such a combination offers ordinary resistance plus inductive reactance, the sum of these being termed impedance. A resistor of low value is used for R2, greatly impairing the amplification at low frequencies, since, as was stated earlier, maximum gain is obtained when load impedance is equal to plate impedance.

The inductance L1, however, will offer more and more resistance as the frequency increases, and at very high frequencies, the impedance will be great enough to outweigh the resistance of R2 and thus greatly increase the amplification gain.

Because at medium or low frequencies the load impedance is too low to match that of the tube, the gain is held down to the same level as that obtained at high frequencies after capacitance losses have taken their toll. Thus these losses, although they cannot be eliminated, can be compensated for. The coupling described provides just the proper adjustment automatically.

Resistance R3 and condenser C3 in this circuit are not merely the usual decoupling circuit; they help improve low-frequency response. At frequencies to which C2 offers little impedance, C3 similarly offers little or none. But at lower frequencies to which C2 offers series impedance, so does C3. While C3 passes the A.C. signals freely to the ground, resistor R3 is to all purposes not in the circuit. But when at low frequencies C3 offers appreciable impedance, R3 becomes effective, increasing the total load resistance and thus the gain. With rightly proportioned values of R2, R3, L1, C2, and C3, an amplifier could uniformly amplify all frequencies from 50 to 5,000,000 cycles.



Wiring under the chassis of a receiver is a studied jumble. The close-up view above is that part shown within the square at left

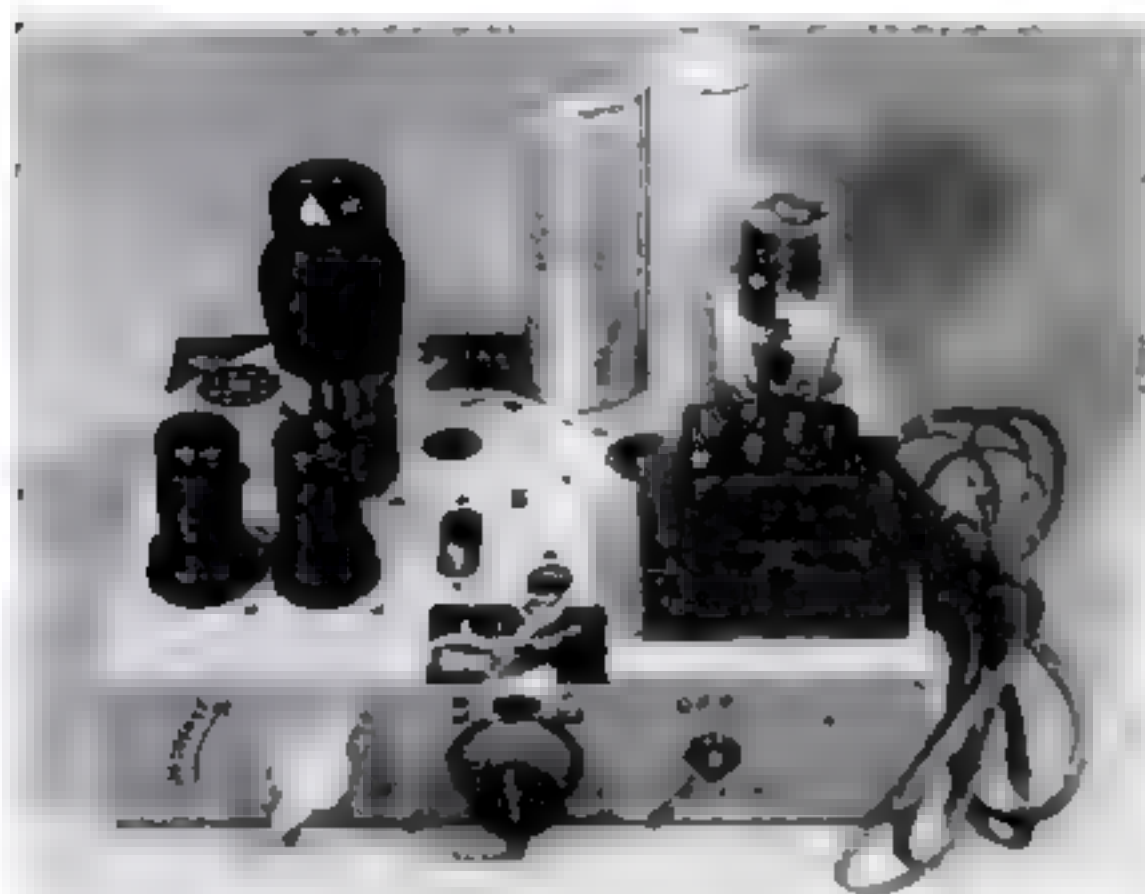


The plate-load resistor is mounted on the tube socket and a decoupling resistor is attached there. Howl results if a plate lead passes too close to a grid lead of a preceding stage



## HIGH-GAIN A. F. AMPLIFIER

### Resistance-Coupled Hookup with Two Pentodes Gives Big Volume



If a power pack is built in, as above, keep it as far from the amplifier wiring as possible. A type-80 rectifier was used here.

SO MUCH gain can be had from this two-pentode hookup that for ordinary purposes the full output will rarely be needed. The amplifier will step up the output of a crystal-detector receiver to full loudspeaker volume. A phonograph pickup or vacuum-tube detector should be connected at the second A.F. input terminals.

As a trick demonstration of electronics, you can even make audible the movement of molecules in an iron bar that is being magnetized. Hook the primary of an old audio transformer or a choke coil across the input terminals and place a big nail or a bolt within the coil. If a small permanent magnet is now brought near the nail, a rushing sound will be heard from the speaker. As the molecules in the bar are pulled into alignment by the magnet, each in flopping over generates an electrical im-

pulse in the coil. This, amplified many thousand times, actuates the loudspeaker.

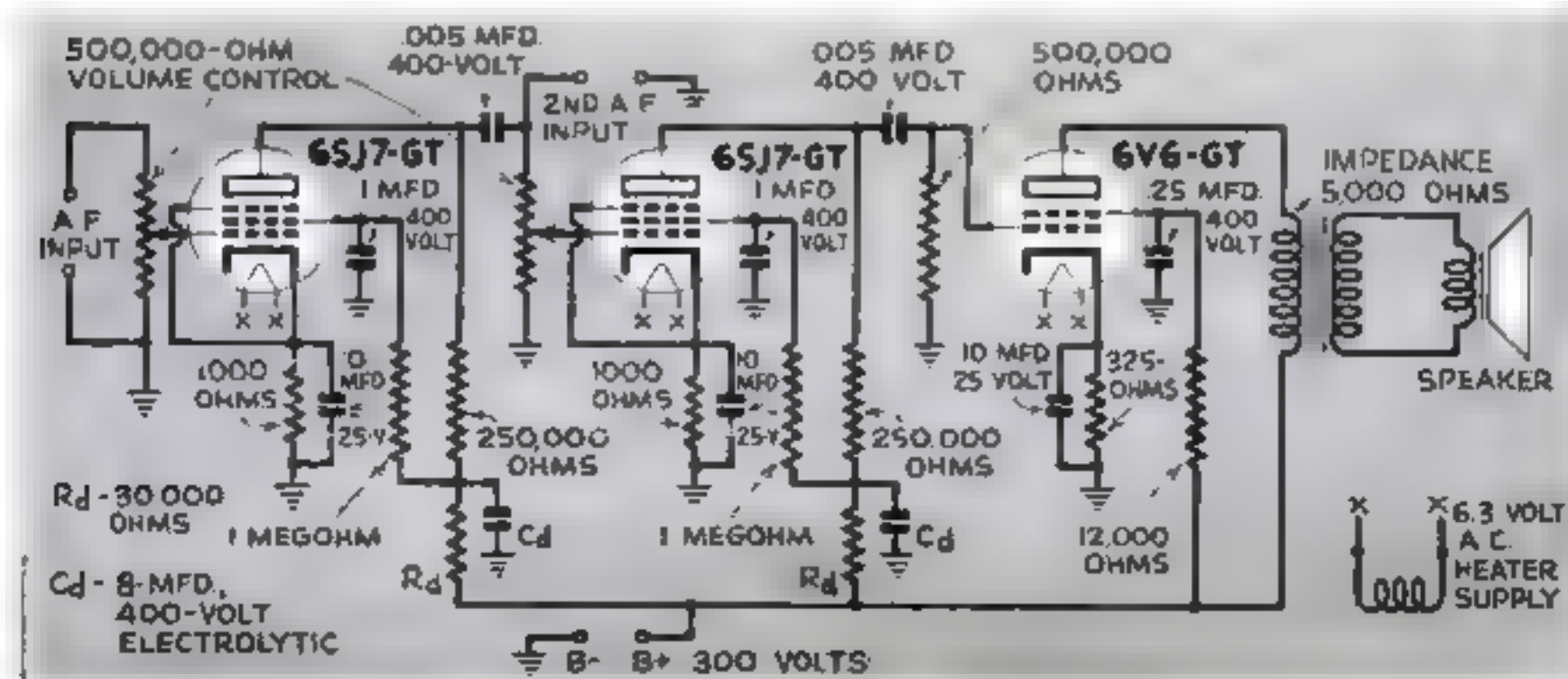
The amplifier is hard to build in proportion to its great sensitivity, and all the precautions suggested in a previous article must be carefully observed. Shielded input leads consisting of a wire enclosed in a braided metal sheath are a "must." The sheath is grounded and serves as one lead, eliminating stray-current pickup. Use an old radio chassis or a tin cigar box enameled black; the chassis must be metal.

Values of the various parts are shown for the 6SJ7 and 6V6, but use whatever tubes you have. Tetrodes will serve in place of the pentodes. Consult the tables of amplifier values in standard tube manuals for data.

applicable to your tubes. In doing so, remember that the second volume control constitutes part of the circuit of the first tube, not of the second. The setting of this control determines what part of the output of the first stage is fed to the second grid.

If 60-cycle hum is present, connect two 50-ohm resistors in series across the heater wires, and their midpoint connection to a 12-volt tap on a 200,000-ohm voltage divider hooked across the high-voltage plate supply. This will give the heaters a positive potential with respect to the cathodes, eliminating electron emission from the heaters to the cathodes, a phenomenon that is sometimes the cause of persistent hum.

It is essential to keep all heater wires as far from the grid leads as possible. Twist them tightly and lay them along a corner of the chassis.





# WHAT TO DO ABOUT INTERMITTENT RECEPTION

## "Servicing Your Radio"

**R**ADIO servicemen and home mechanics are often hard put to find the cause of intermittent or fading radio reception. A receiver working perfectly one minute may drop in volume or fade away completely the next, perplexing the repair man no less than it exasperates listeners. Banging the cabinet, flicking the switch, or simply walking heavily across the room will often jar the radio back to life, but this is only a temporary expedient, and the reception is sure to fade again later on. In the following instances several of the more common manifestations of such trouble were traced to their source, and lasting remedies were applied.

A small A.C.-D.C. five-tube superheterodyne was afflicted with abrupt increases and decreases in volume. The fluctuations usually occurred when house lights were turned on or off. It was found that the .05-mfd., 400-volt tubular condensers in the grid returns of the A.V.C. tubes (Fig. 1) were faulty. These had to be replaced.

Similar trouble was experienced by the owner of a set that could be stirred into renewed operation only by snapping the on-off switch or turning on a house light. After all tubes were checked, it was discovered that reception could be restored by touching the plate leads of the first detector or converter tube, or the IF leads or oscillator-tube leads. This led to the trouble being traced to a defective detector-cathode by-pass condenser (Fig. 2).

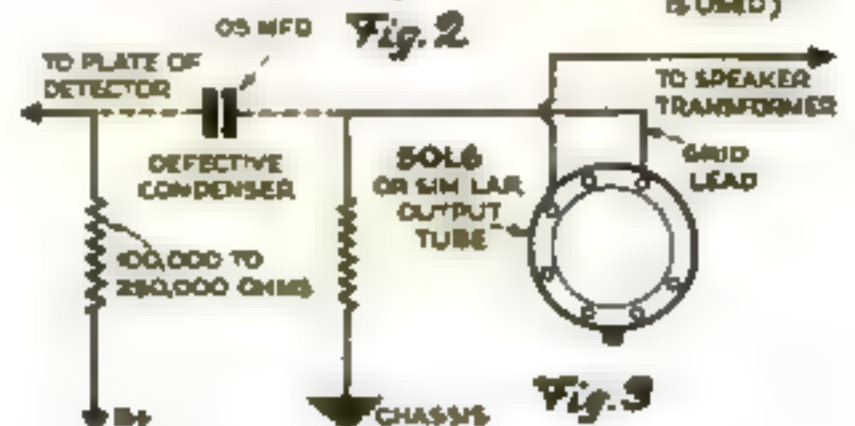
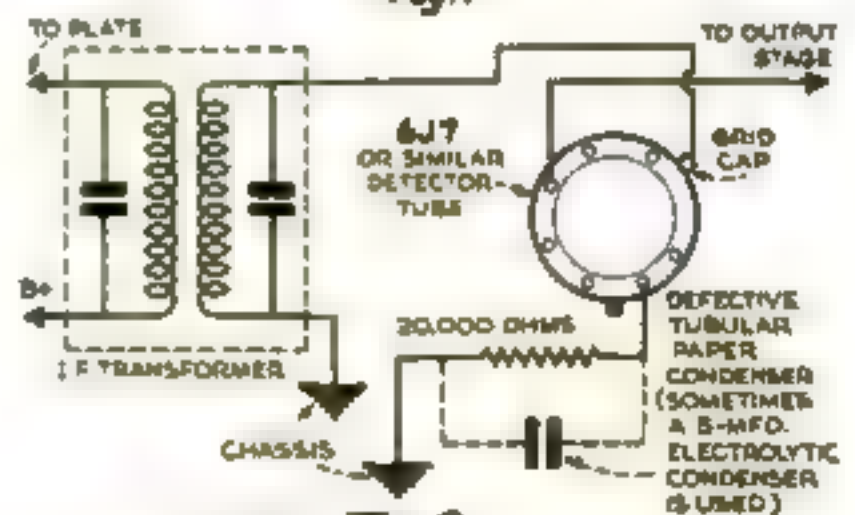
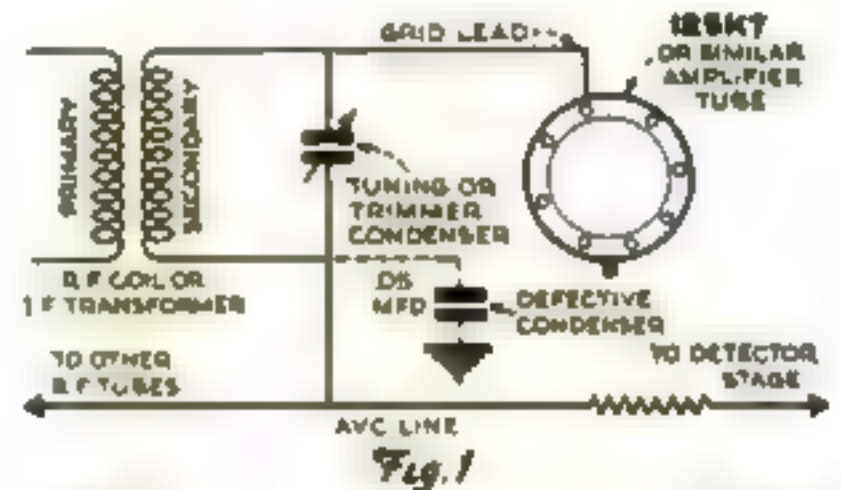
Frequently intermittent reception is due to a faulty coupling condenser in the grid circuit of a power-pentode tube (Fig. 3), such as a 50L6 or a 43. This causes a radio to lose volume suddenly. The fault can be corrected only by replacing the condenser, which usually has a value of .05 mfd., 400 volts.

Intermittent reception is also often caused by dirty wave-band switches. Hardened flux or grease may accumulate on the contact points, which can be easily cleaned with carbon tetrachloride and a small cloth or toothbrush, as shown in the photo. Even if a switch tests O.K. on 110 volts, it will still cause intermittence if the contacts are not clean.

Radios with weak or noisy reception may owe their eccentricity to corrosion of R.F. or I.F. grid-return leads at the chassis. These points should be carefully inspected. Usually it is best to install a common ground wire and connect grid returns to it.

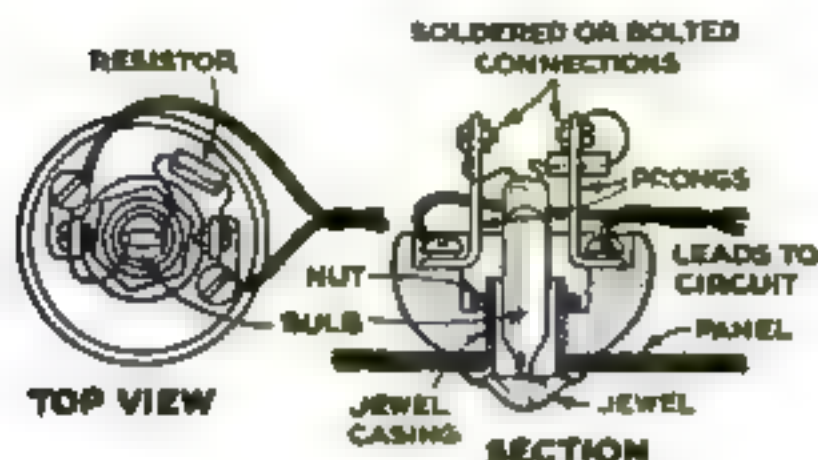


Dirty wave-band switches often cause intermittent reception. Clean them with carbon tetrachloride





# radio ideas



**MIDGET NEON BULBS** of the baseless, resistor type make desirable pilot and indicator lights where high visibility is not required, since their small current consumption contributes to their long life. Ordinary appliance plugs can be used as panel mounts for these bulbs if the cord hole is reamed out to fit over the threaded casing of a pilot-light jewel so that the assembly can be secured on the panel, as illustrated above. The tip end of the bulb is inserted in the casing, and the leads from it and its resistor are connected to the ends of the plug prongs. Short leads and a drop of sealing wax hold the bulb in position. Binding screws on the plug are used to connect the device into the circuit.

**A POWER PACK** for furnishing plate current to a radio or amplifier, or for experimental purposes, can be built from four discarded 35Z5 rectifier tubes. These have a double filament, one side of which serves as a resistor for the pilot light, and this usually burns out first.

As shown in the diagram below, the unit is essentially a voltage doubler, and no transformer is needed. The filter block has two 8-mfd. condensers and one of 16-mfd. capacity across the output terminals. This should have a rating of at least 250 volts; one of 450 volts would provide a better safety factor. The field coil of a small dynamic loudspeaker with a resistance not exceeding 450 ohms may be used as a filter choke.

A voltage doubler such as this must never be used with grounded apparatus,

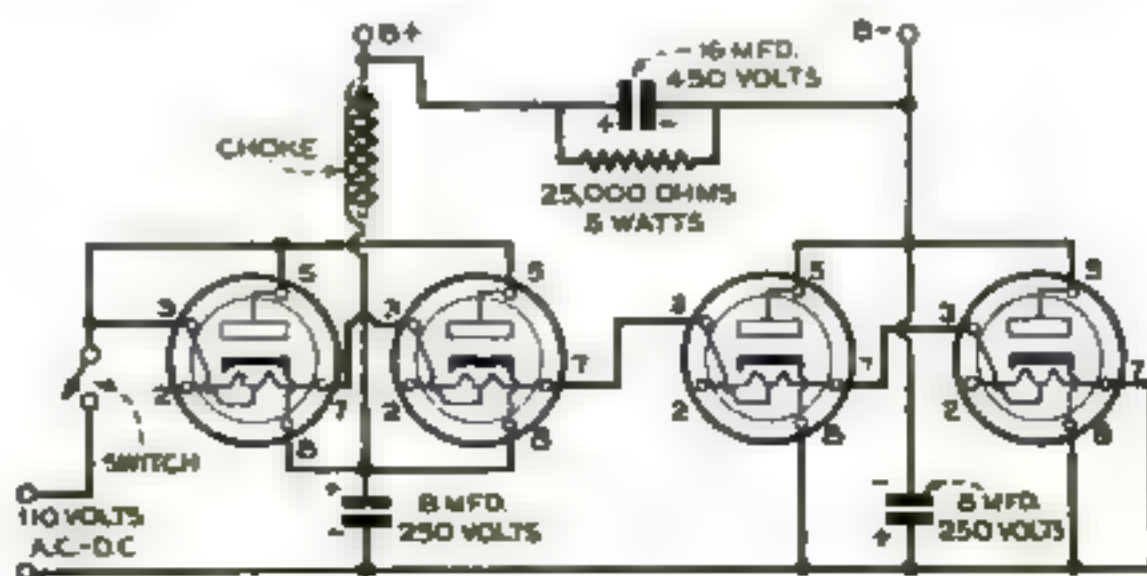
**BROKEN DIAL CABLES** can be replaced with a good quality of stout thread that has been given a simple toughening treatment. First soak the thread in alcohol and then, while it is still wet, draw it back and forth across a piece of rosin until the rosin has been thoroughly worked into every fiber. Greatly increasing the strength of the string and giving it surprising durability, the process also imparts tractive power sufficient to keep it from slipping on the pulleys of the ordinary set. The string should be allowed to dry thoroughly before installation.

**SEALED RELAYS** like that at the right will fit any standard octal socket, providing delays of one to 100 seconds when installed in transmitters as automatic cutoff or cutin devices. They are compensated for ambient changes of  $-40$  to  $+100$  deg. F. This type of relay is available as a single-pole device with either normally open or normally closed contacts. It is capable of handling up to 12-amp., 115-volt A.C. or D.C. The contacts are hermetically sealed in inert gas to prevent oxidation.



as for example a radio, unless the equipment is grounded through a 100,000-ohm resistor with a .1-mfd. paper condenser in parallel. Should touching the set cause a mild shock, try reversing the wall plug.

Two tubes instead of four would deliver enough current for small radios, but the two tube heaters cannot be connected across the 110-volt line without also using a suitable line-cord resistor.—WALTER ANDERSON, JR.





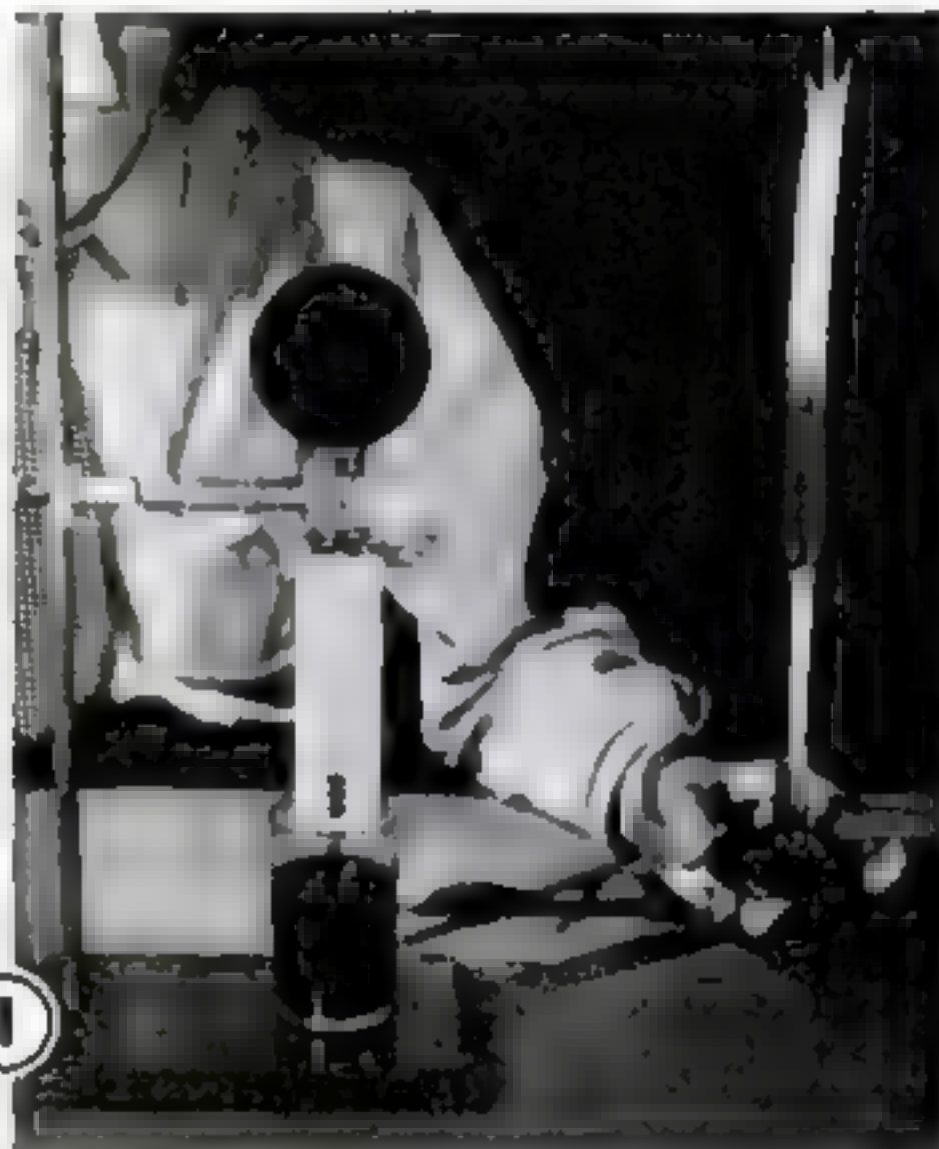
# home EXPERIMENTS

**1 A BLUE GAS FLAME** is much hotter than a yellow one, but heat from the latter can be felt more strongly at the side, as can be shown with an air thermometer such as the one pictured below. A small flask with a one-hole stopper through which runs an 8" length of glass tubing will serve as a thermometer. Smoke the flask so it will absorb heat rapidly, invert it while warm in a glass of colored water, and place a ref-

erence scale behind it; then let it cool to raise the liquid to a convenient height. Now stand a Bunsen burner about 12" to the side and let it burn first with a blue flame and then with a yellow. Heat from the yellow flame will expand the air in the flask and depress the indicator fluid further than will that from the blue flame. This is because heat waves—similar to light waves but invisible—are radiated from the yellow flame by luminous, incompletely burned particles of carbon. Less loss of heat by radiation helps keep the blue flame hotter.

**2 BREATHE INTO A FLASK** and stopper it tightly as soon as the inside is coated with condensed moisture. Although the moisture cannot get out, it will disappear

## FIVE SIMPLE EXPERIMENTS IN THE HOME LAB SHOW





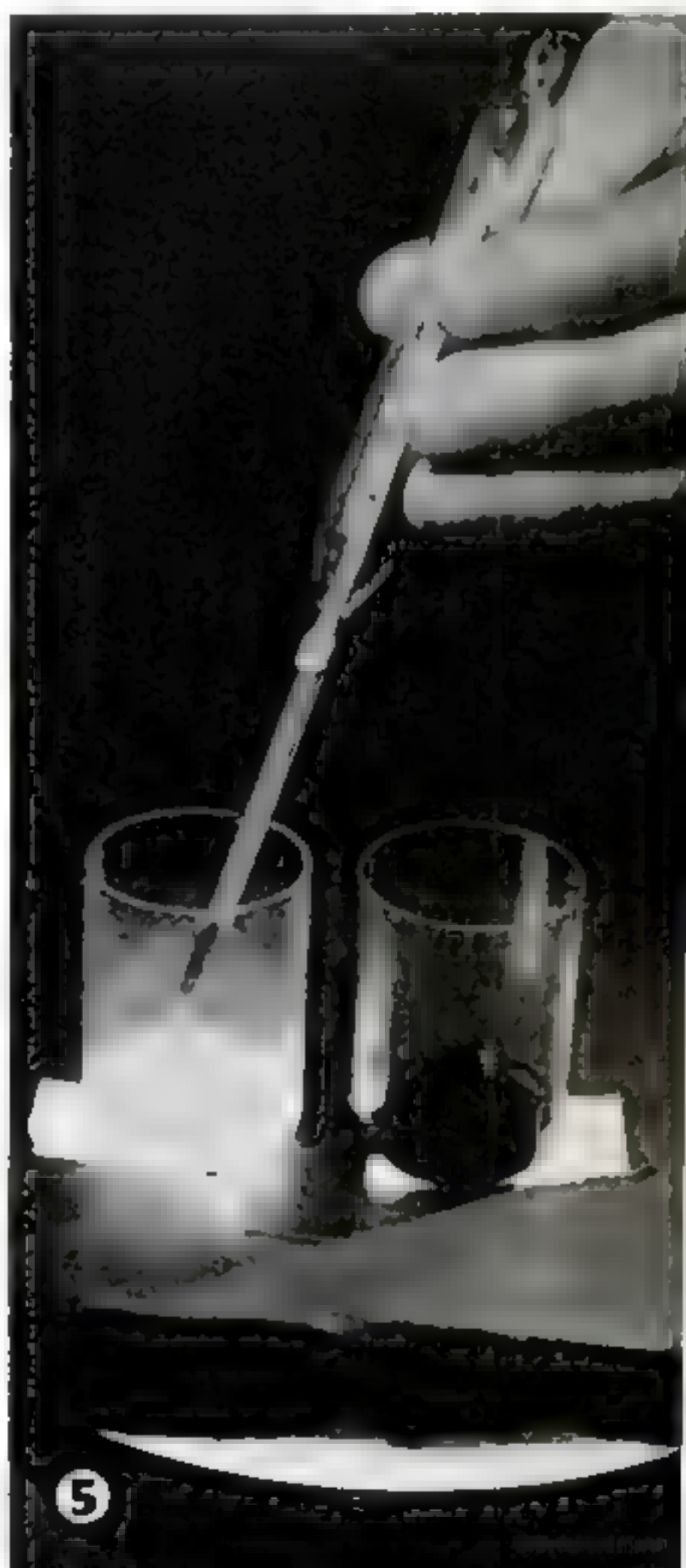
if the flask is warmed. To show it is still present, let the flask cool, and the moisture will condense again. At room temperature, the air in the flask is saturated with moisture, but it readily takes up more as its temperature is raised.

**3 BLACKEN ONE SIDE** of a tin can with smoke from a candle flame; then fill the can with boiling water. Hold one hand near the smoked half and the other near the bright side, and you find heat thrown off from the dark side considerably greater. This is because the bright metal retains heat longer. In practice, dark-colored steam radiators and cooking pots with blackened bottoms prove more efficient for their purpose than bright ones.

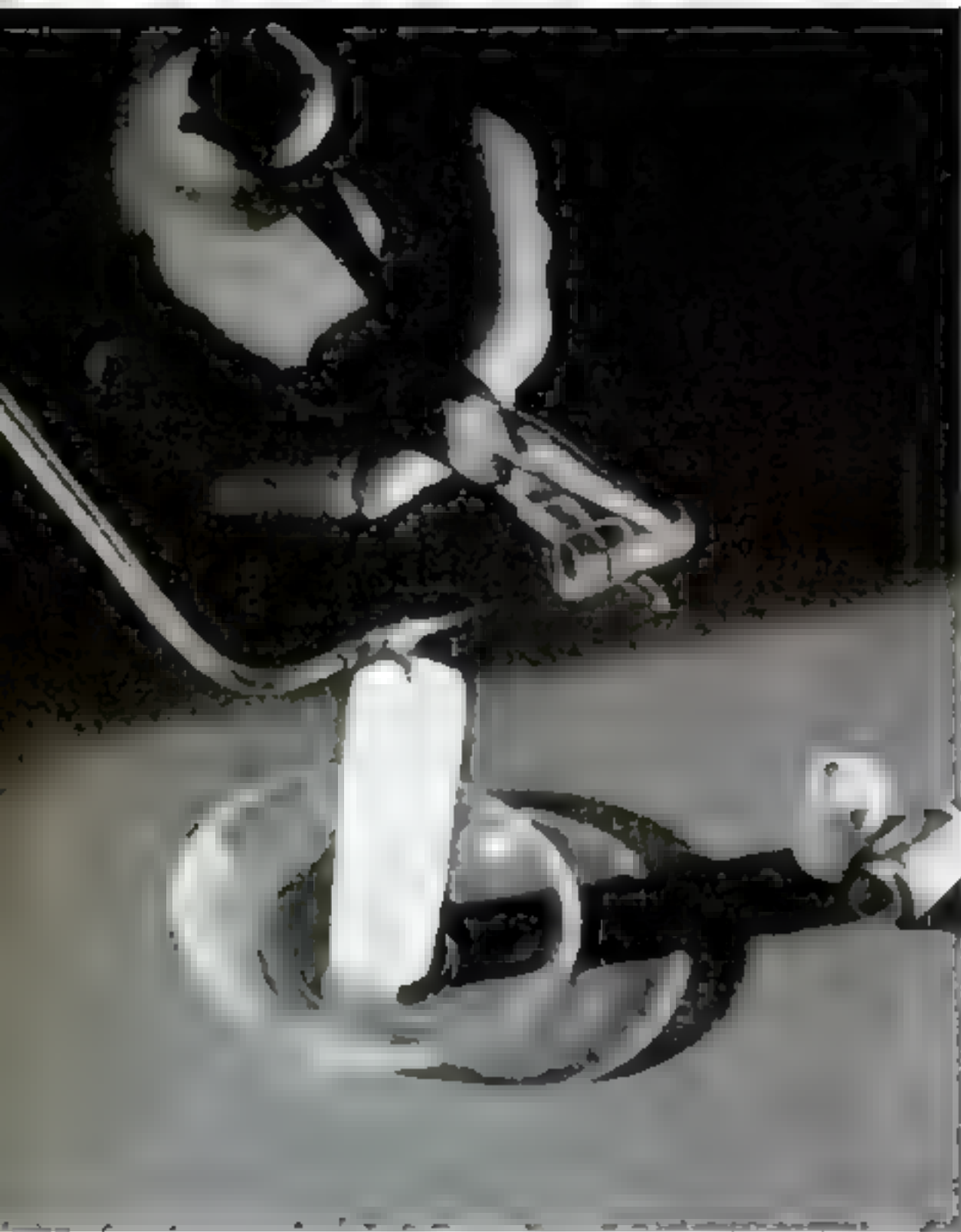
**4 FIRE MAKES WATER** when a cold flat-iron is held over a gas flame. On combustion, hydrogen in the gas combines with oxygen and collects as moisture on the iron. It would evaporate if the iron were hot.

**5 HEAT AND LIGHT WAVES**, though similar, do not always travel with equal ease through the same mediums. Support over an electric bulb a glass containing crystalline alum, which passes light readily, and another containing a strong solution of iodine, which is opaque to light. A thermometer will register higher when held over the iodine than it will over the alum, showing that the former passes more heat rays. Put into the substances, it will show that the alum, absorbing more heat, is hotter.

## ODD FACTS ABOUT THE PROPERTIES OF HEAT AND FLAME







# Catalysts

... SECRET AGENTS OF CHEMISTRY

By KENNETH M. SWEZEY

**B**Y MEANS of a new catalytic oil-cracking process, American industrial chemists claim they can now produce a superfuel which is superior to any gasoline heretofore commercially available. Mix this fuel with ordinary gasoline, and present airplanes will travel faster or carry greater loads. Use it alone, and the fuel permits the design of engines tremendously more powerful and faster than those used today.

Once more a catalyst has worked a miracle, and by so doing has again attracted the attention of the public to one of the most mysterious and fascinating subjects of modern chemistry.

In newspapers, schoolbooks, and in these home chemistry articles, we have read how

catalytic processes help make sulphuric and nitric acids, ammonia, dyes, alcohol, plastics, synthetic rubber. In hundreds of other processes we seldom hear of, some catalyst is equally vital. Just what is a catalyst, and how does it work?

The answer to the first part of the question is easy, but the second poses a problem which chemists have never solved satisfactorily. A catalyst is a substance which can change the speed of reaction between two or more other substances, without being permanently changed or used up. Jokingly, it has been called a chemical parson—an agent which can bring about the union of other substances and yet remain unchanged itself.

Sometimes the speed of reaction can be accelerated by a catalyst to such a tremendous degree that the catalyst seems to produce the reaction. Take a little mound of dry baking powder, for instance. As long as this powder remains perfectly dry it might remain almost indefinitely without decomposition. If you add a few drops of water, however, the seemingly inert powder immediately froths up with volumes of gas. Plain water has in this case acted as a catalyst, helping the acid compound and the sodium bicarbonate to unite, liberating carbon dioxide. The water is not changed by the reaction.

Water is probably the most universal catalyst. Many chemical reactions apparently cannot take place without at least a trace of moisture. You can easily demonstrate a violent and vivid reaction

between normally nonreactive materials, initiated by a single drop of water. Because of the dense, choking fumes produced, it is best to perform this experiment outdoors, or near an open window.

Powder some dry iodine crystals in a mortar and mix thoroughly with this powder an equal volume of powdered aluminum, first making certain that both substances are absolutely dry. Place a little mound of the mixture on the center of an asbestos pad. Now add a drop of water in a depression on top of the mound, and stand back. Almost instantly, purple-red vapors rise from the heap. In another second, the mound bursts into beautiful purple-red flame, accompanied by great volumes of smoke.



Berzelius, the great Swedish chemist, devised the term catalytic agent in 1836. Long before that, however, catalysts had been used. Sulphuric acid, for example, served as a catalyst in making ether—or "sulphuric ether," as it is sometimes still called. Ether—or, more properly, ethyl ether—is produced from ethyl alcohol when two molecules of the alcohol lose one molecule of water. Sulphuric acid helps remove the water.

To demonstrate this transformation in your home laboratory, pour about 2 ml. of denatured alcohol into a test tube and carefully add an equal amount of concentrated sulphuric acid. Pour in the acid very slowly, mixing the solution cautiously with a glass stirring rod. Now heat the mixture gently over a small alcohol or Bunsen flame. Keep the tube turned away from you, and do not bring the mixture to a boil. This experiment is entirely harmless if you follow directions; the cautions are merely to prevent any spilling or spattering of the strong acid, which might cause serious burns to yourself or damage to your workbench.

After heating the acid-alcohol mixture for a few seconds, pour it into about 20 ml. of warm water in a beaker. The presence of ether can immediately be detected by its smell. The sulphuric acid is merely diluted by the water removed from the alcohol during this reaction. None of the acid is otherwise altered or lost.

A common home chemistry experiment shows how manganese dioxide serves as a catalyst to release oxygen from hydrogen peroxide. Here is a method of demonstrating this catalytic process even more vividly. Pour a little hydrogen peroxide into a tall glass or beaker and mix with this a few drops of some soapless shampoo. Now drop in a few grains of powdered manganese dioxide. Instantly, oxygen released from the decomposing peroxide starts making foam, and if enough solution is used, the foam will finally overflow the glass.

Perhaps without realizing it, you use a catalyst every time you mix a drier into paint. The drying of linseed oil is not merely evaporation, such as occurs when turpentine dries. It consists of a hardening

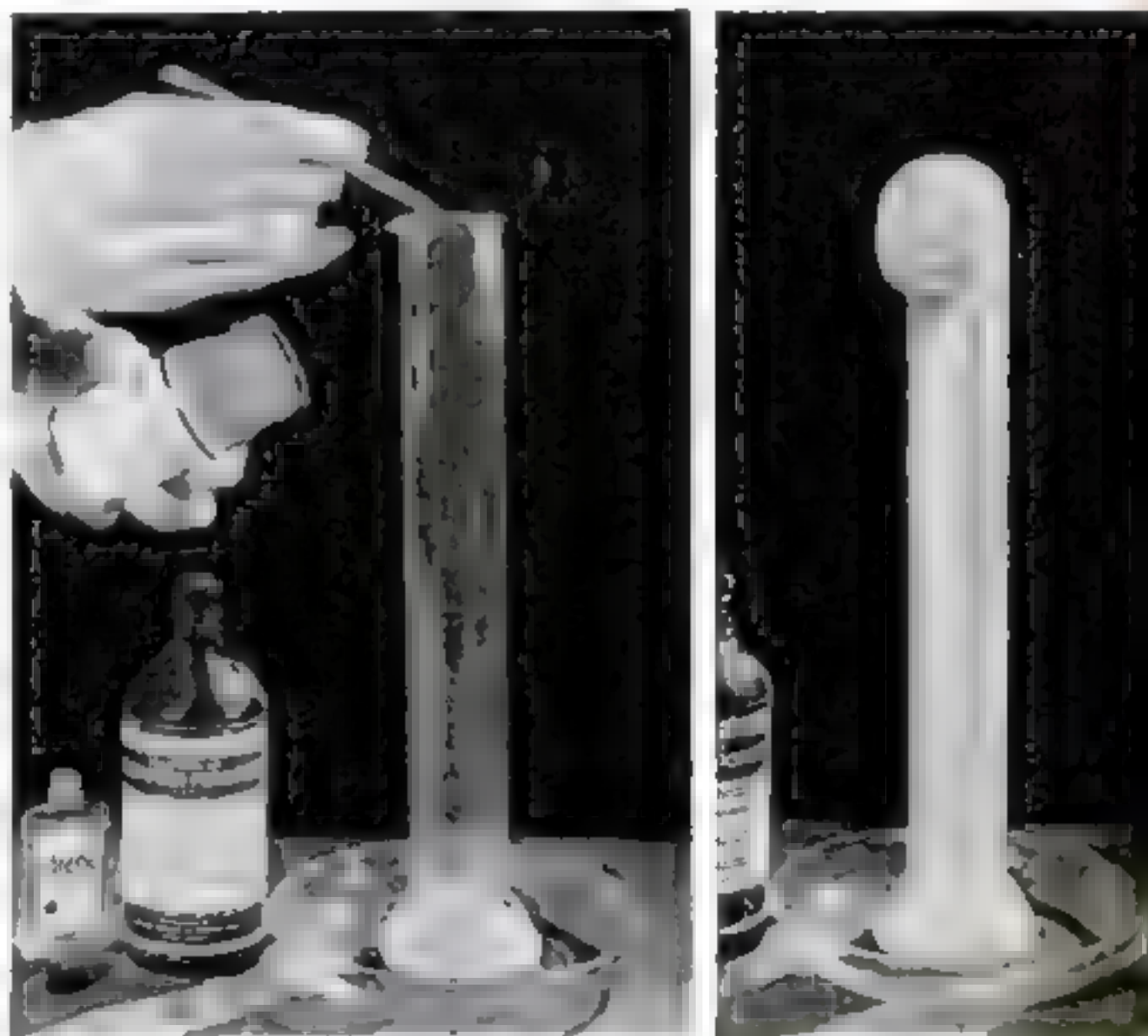
of the oil into a tough film, caused by oxidation of the oil. Driers, which usually consist of borates or resins of manganese, cobalt, or other metals, help hasten this oxidation.

You can easily make some manganese borate, a typical drier, and find out for yourself how it works. Dissolve a little borax in one portion of water, and a little manganese sulphate or chloride in another portion. If you now mix the two solutions, a flesh-colored precipitate of manganese borate will form. This substance is recovered by filtering off the liquid. While still on the filter paper, it is washed with water to remove impurities and is then dried.

Now paint two strips of cloth with linseed oil—one with plain oil, and the other with oil in which a few grains of the manganese borate have been mixed. After exposure to the air for a day, the cloth coated with linseed oil containing the drier becomes dry and stiff; while the other cloth, coated with plain linseed oil, is still limp and wet.

The catalysts thus far mentioned have been powders or liquids which have been mixed with the substances between which they have promoted a reaction. In another type of catalyst the reaction occurs when gases or other substances are caused to unite by being strongly adsorbed together on the surface of some metal, such as spongy

When a catalyst, a few grains of manganese dioxide, is dropped into a tall beaker holding some hydrogen peroxide, a rapid decomposition of the peroxide ensues. If shampoo is added, liberated oxygen makes foam







Water is often a catalyst. Here a single drop, added to powdered iodine crystals and powdered aluminum, is sufficient to make the mixture burst into colorful flames. Do this in a ventilated room



platinum, platinum black, copper, or finely divided iron or nickel.

The flameless, sparkless stove lighters of the past, as well as modern flameless cigarette lighters, depend for their operation on catalysts of this type. In these lighters, illuminating gas in the first case, and alcohol vapor in the second, oxidizes vigorously upon touching the surface of a platinum or palladium catalyst. The intensity of the reaction causes the catalyst to heat up to redness.

When lighters of this kind fail to work properly, the trouble often springs from a "poisoned" catalyst, a condition produced by an accumulation of dirt or soot on the surface of the catalytic metal. (Because an extremely small quantity of an impurity can affect the power of a catalyst, chemists sometimes use this fact to make sensitive analyses. For example, very minute concentrations of cyanide can be detected by their effect in reducing the catalytic activity of platinum.) If your flameless cigarette lighter has a catalytic element coated with soot, you can usually renew it by holding the unit for a few seconds in the tip of a blow-pipe flame, as shown in the photo on page 190.

Smooth copper screening is used as a surface catalyst in changing methyl alcohol into formaldehyde by a process of slow oxidation. This reaction can easily be demonstrated with the

aid of a small spiral of copper wire. Procure about eight inches of No. 14 or 18 bare copper wire and form the end into a spiral by winding it around a pencil.

Gently warm a little methyl alcohol in a test tube. Heat the copper spiral in a Bunsen flame to dull redness, and then plunge this coil into the vapor in the test tube. Any coating of black copper oxide which may be on the wire immediately vanishes, and the pungent odor of formaldehyde issues from the tube. The hot copper causes the alcohol vapors to unite with oxygen from the air and from its own oxide.

Fame awaits whoever solves the mystery of why catalysts produce their results.

Metallic catalysis can be demonstrated with a spiral of bare copper wire heated to a dull redness. Placed in the vapor of warm methyl alcohol, it causes an alcohol-oxygen reaction, indicated by an odor of formaldehyde







A quick upward motion of a large ring encloses a boy, who is himself blowing a bubble, within a cylinder of soap film. Below, Eiffel Plasterer, an Indiana teacher who has made bubbles a hobby, displays a bubble chain



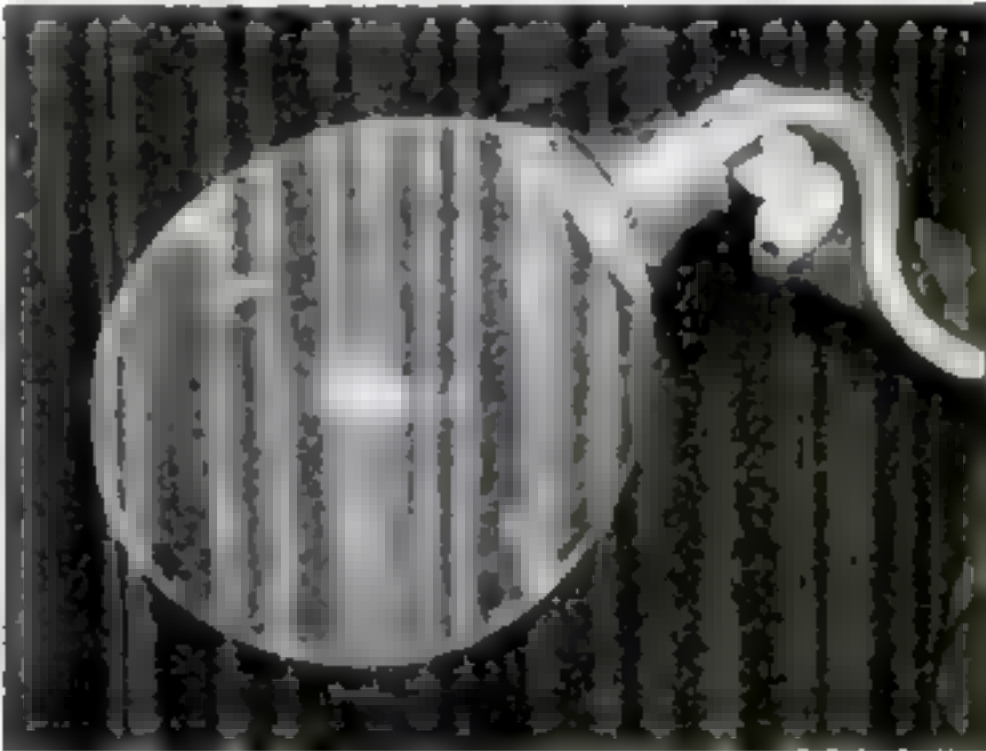
## TRICKS WITH Soap Bubbles

A SPECIAL solution, simple equipment, and a little practice will produce amazing soap bubbles and a whole routine of surprising tricks. Mix 8 oz. of distilled water or rain water, 1 oz. pure Castile or palm-oil soap shavings, and 4 oz. of pure glycerin. Add the glycerin when the soap has dissolved, stir thoroughly, and siphon off the clear liquid which will collect at the bottom.

A glass tube 1" in diameter, with the bubble-forming end cut at a 45-deg. angle, will serve for blowing medium-sized bubbles, while a large funnel or bell-shaped reflector will make bubbles up to 2' in diameter. Another way to produce giant bubbles is to bend a wire coat hanger into a large loop, immerse it until a film covers the loop, and then swish it through the air.

By using a hydrogen generator and tubing with a T-shaped fitting, bubbles can be filled with an air-hydrogen mixture; they will soar like balloons and explode if touched with a lighted cigarette. If a loop of fine aluminum wire with a thread tied to it is coated with a film and a gas-filled bubble is placed on the ring, light objects on the thread can be floated in the air.—R. M. LUTHER.

Bubbles 2' in diameter can be made with an old vacuum-cleaner hose attached to a flaring metal utensil. Use glycerin to increase bubble life. Mr. Plasterer has blown one that lasted 180 days

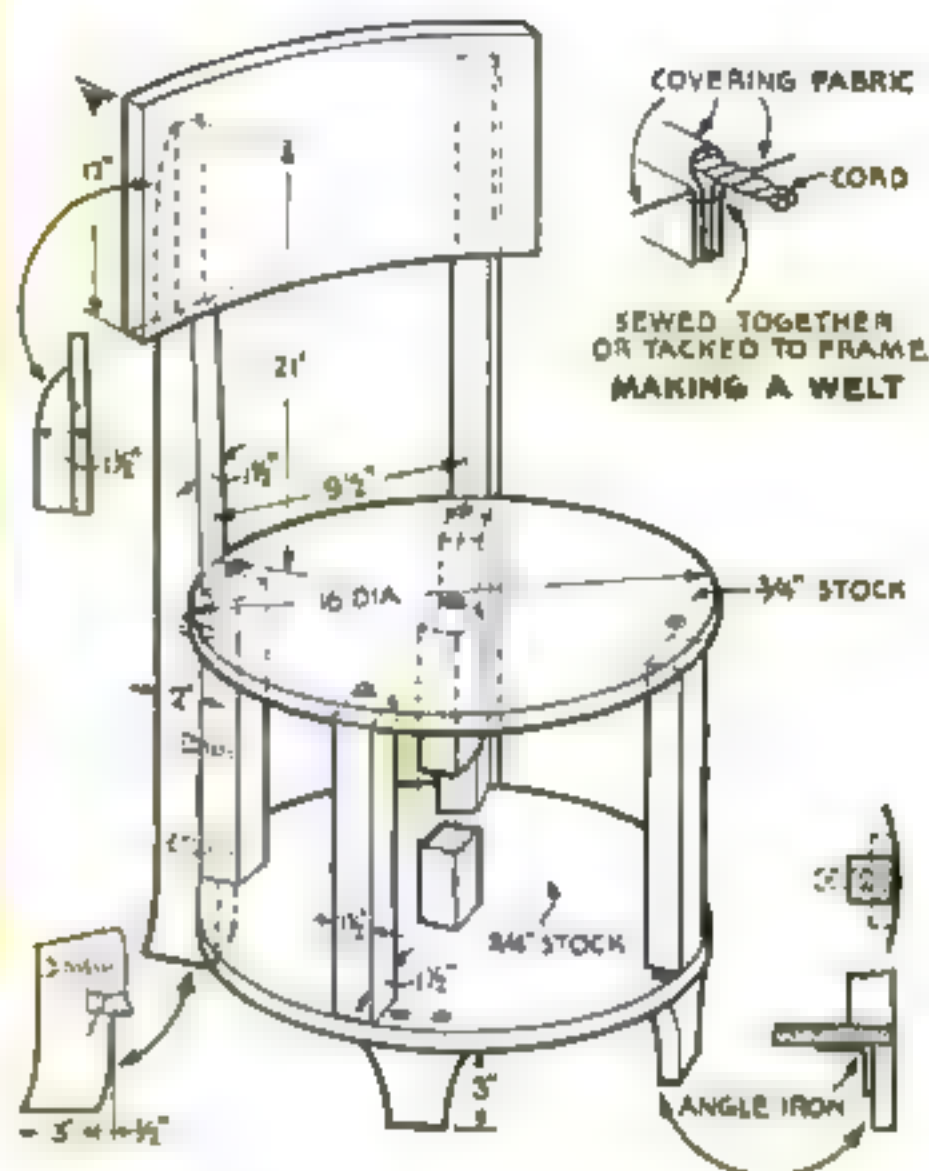






# Vanity Chair Adds

HOMEMADE FRAMEWORK CAN BE



**C**REATING and finishing a circular bedroom chair will prove to be an interesting project as well as provide an appreciated gift for a friend. The frame for the chair can be rough, but it must be well put together. The style of upholstering and the type of covering should harmonize with the furnishings and colors of the room where the chair is to be used. Flowered chintz or cretonne, or an over-all conventional pattern are appropriate, and the chair can be upholstered with or without a pleated skirt, as shown in the photos.

The frame for the chair includes two pieces of  $\frac{3}{4}$ " wood 16" in diameter. It is not necessary that these round pieces be of solid wood, or even made up of glued pieces. Separate boards can be held together with cleats fastened to the inside surfaces where they will be hidden from view by the upholstery.

Cut five pieces of  $1\frac{1}{2}$ " by  $1\frac{1}{2}$ " stock 13" long. Screw two of these fast to the bottom disk  $9\frac{1}{2}$ " apart, two others at equal intervals around the disk, and the fifth in the center. Fasten the upper disk atop these. Shape two tapering back posts  $38\frac{1}{2}$ " long. Either tapered or turned front legs may be used, but they should be held firm with angle irons. Rear legs are formed by the back posts. The

## STEP-BY-STEP OPERATIONS



Burlap pinched around cotton stuffing is tacked to the seat to form the soft bulge of a roll edge



# Luxury Touch to a Bedroom

## UPHOLSTERED WITH EITHER PLEATED OR TAILORED COVER

height of the frame allows for  $1\frac{1}{2}$ " of seat stuffing, so the chair seat will be 19" above the floor when completed.

A curved back rest can be made from several pieces of thin wood bent and glued up to the desired thickness, or one wide board can be kerfed, steamed, and bent. Another way to make a curved back is to cut three sections from barrel staves.

After the frame has been completed, cover the entire side with burlap or some other heavy fabric, and tack a strip of burlap around the upper, outer edge of the frame. Then pinch this burlap around cotton stuffing sufficient to form a roll edge that will bulge about  $\frac{1}{2}$ " beyond the seat all the way around. Close the roll by tacking the pinched-in edge of the burlap to the top of the seat, as shown in the photo on the facing page.

Fill the top with stuffing, and tack the fabric cover evenly all around, directly under the roll edge. A welt, which is a cord covered with fabric, is then tacked all around. On the chair with plain, tailored sides, a layer of cotton felt is placed all around and covered over with fabric. On

the pleated-skirt chair, it is not necessary to use cotton felt on the sides, a piece of white, unbleached muslin tacked over the burlap being sufficient.

After a trial fit on the back posts, unscrew the back rest and upholster it, first dividing it into five equal sections. For the three middle sections, cut a piece of material 3" wider than their width, and cut two pieces for the end sections 5" wider, allowing enough material for tacking to the rear of the frame. Sew all five pieces of material together, and tack the seams to the marked sections on the back.

Fill the sections with cotton felt, beginning with the center section and filling end sections last. Tack a cover to the rear of the back. This cover for the rear of the back should be large enough to permit the edges to be turned under and tacked on with gimp tacks or to be sewn by hand to the edges of the front cover fabric that has been drawn over and tacked. Sewing of upholstery on a frame is best done with upholsterer's straight or curved needles. Finish the wood as desired.—HERBERT EAST.

## IN PADDING AND APPLYING THE UPHOLSTERY



Legs and back posts are put on, and the curved back is screwed in place



The seat is covered and muslin put on the side, ready for the pleated skirt



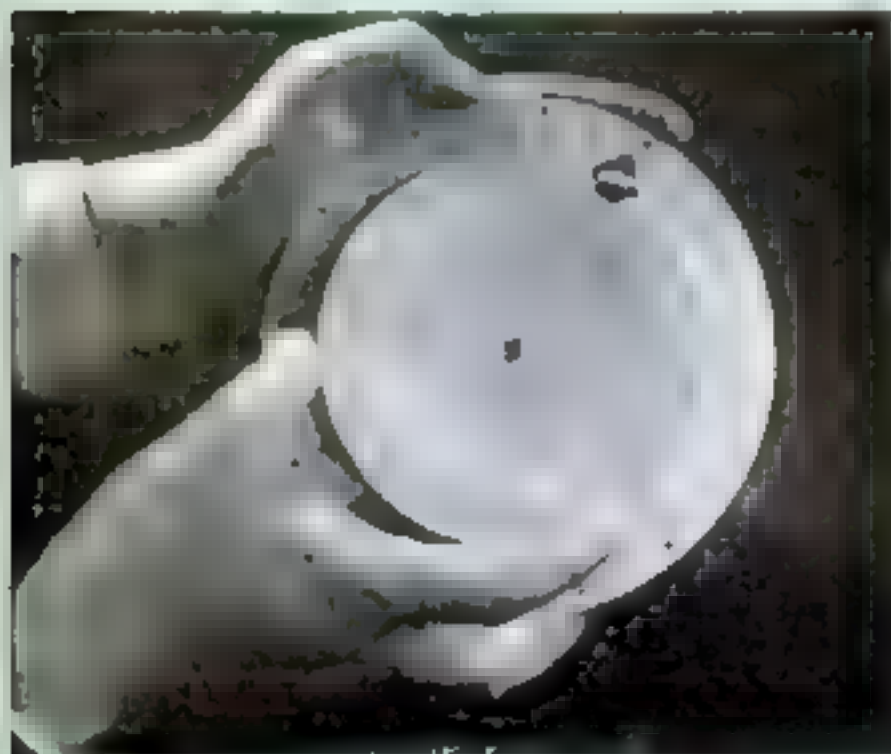
For a tailored effect like this, one layer of cotton felt is applied before the side covering is put on. The same framework is used. In the photo at left, part has been left uncovered to reveal the construction



OF INTEREST TO

## HOME OWNERS

**FUEL-OIL CONSUMPTION** in rationed areas can be checked instantly for any time of year with the aid of the dial calculator shown below. The pointer is placed opposite the annual fuel allotment, and a reading on the circumference of the disks will give the amount—based on authentic degree days and temperature charts—that may safely be burned in any day, week, or month to keep within the limits of the total allowed.



**MODERN CEDAR CLOTHESPRESSES** can be made from old closets simply by papering with a wallpaper that is actually manufactured from cedar wood and is treated to retain its odor. The paper comes with an adhesive base, can be applied quickly after preliminary immersion in water, and has a grain finish.

## Bathtubs and Garden Hose of New Plastic Construction

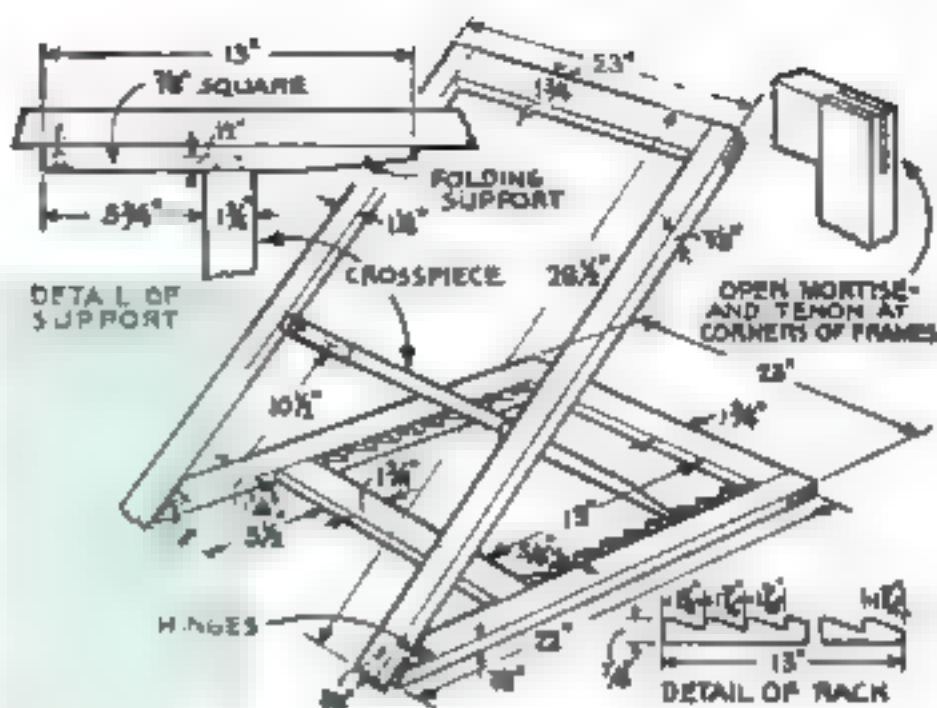
Use of versatile plastics has now been extended to both bathtubs and garden hose—the former a hard, rigid unit with a synthetic-enamel finish resembling that of a metal tub, and the latter a flexible length of tubing much lighter in weight than rubber and capable, the manufacturers say, of withstanding more pressure.

The over-all dimensions of the tub are 14" by 28" by 58½", suitable for installation in the average bathroom. Plastic hose, made only in ½" size, is available in 50' lengths with couplings and can be connected to an ordinary rubber hose.





## Back Rest for Use in Bed Has Folding Frame and Quickly Adjustable Angle



## LIST OF MATERIALS

No.	Pc. Description	T.	W	L.
2	Sides	7 $\frac{1}{2}$	1 $\frac{1}{4}$	28 $\frac{1}{2}$
2	Sides	7 $\frac{1}{2}$	1 $\frac{1}{4}$	22
2	End rails	7 $\frac{1}{2}$	1 $\frac{1}{4}$	33
1	Middle rail	7 $\frac{1}{2}$	1 $\frac{1}{4}$	22
1	Support brace	7 $\frac{1}{2}$	1 $\frac{1}{4}$	19 $\frac{3}{4}$
2	Supports	7 $\frac{1}{2}$	7 $\frac{1}{2}$	13
2	Saw-toothed racks	7 $\frac{1}{2}$	7 $\frac{1}{2}$	13

MISCELLANEOUS 1 pair hinges, 24" length of webbing, 26"x30" cover fabric and 2 1 1/2"—No. 16 flathead screws.

Note: All dimensions are given in inches.

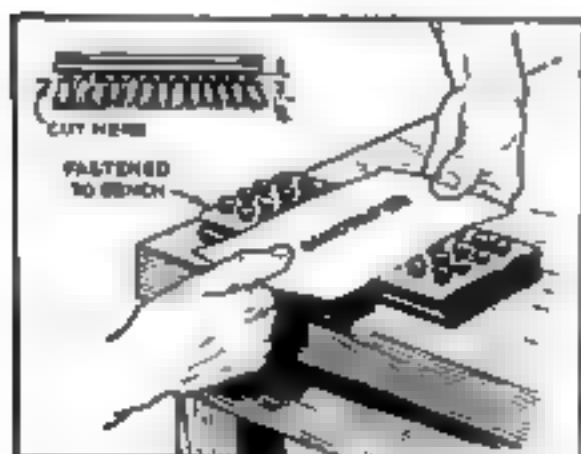
No rigid brace that will cause discomfort is used behind the fabric covering the adjustable back.

REALLY comfortable back rests are indispensable for invalids, and they are always a convenience to persons who like to read in bed. Such a back rest can be made of two frames hinged together. It folds flat and is adjustable to various angles to suit the preferences of its users.

The upper frame has two sides and one end rail, while the lower frame has two sides, one end rail, and one middle rail. Sides and end rails are joined with open mortises and tenons, while the middle rail is blind-mortised into the sides. Be sure that the lengths between shoulders are alike on the three rails.

A saw-tooth rack is glued to the inside edge of each side of the lower frame. The supports, which rest on these racks, are joined with a brace mortised into them. They fit inside the upper frame, to which each is fastened with one countersunk flat-head screw. Taper the ends to fit into the saw-tooth racks.

The two frames are fastened together with hinges screwed on the faces of the side pieces, as shown in the drawing. Finishing will depend upon the kind of wood used, but the entire back rest should be perfectly smooth with all edges and corners rounded off. A piece of webbing is nailed across the bottom end of the upper frame before final covering with a strong and attractive upholstery fabric.—HERMAN HJORTH.



## Scrubbing Brush Cleans Used Sandpaper

ONE or two rubs of an ordinary scrubbing brush will remove pulverized wood particles stuck in the grit of sand-paper and garnet paper, and thereby prolong the efficient cutting of the abrasive. An old scrubbing brush will serve the purpose as well as a new one if its bristles are cut down to a uniform length. If the brush is fastened to a wall or to the workbench, it will be handier for frequent use during a sanding job.—W. F.



# Overhauling Corn Planters Pays

By E. W. LEHMANN

Head of Department of Agricultural Engineering, University of Illinois

**J**UST how important it is to keep a corn planter in first-class condition is best realized, sometimes painfully, when the planting season is over and the seed comes up. Then the farmer can tell how well or how poorly he planted by the stand he gets.

If the crop bids fair to be a good one, he should consider himself well repaid for time he spent on the maintenance of his planter.

It will be too late then to do anything about scrawny rows with skips and too few stalks if a defective planter, or one with wrong plates, was used. Moreover, a reduced yield will not be the only disadvantage of underseeding, because the cost per bushel of the entire crop will be increased. A poor stand costs as much as a good one to cultivate with a power cultivator and harvest with a corn picker.

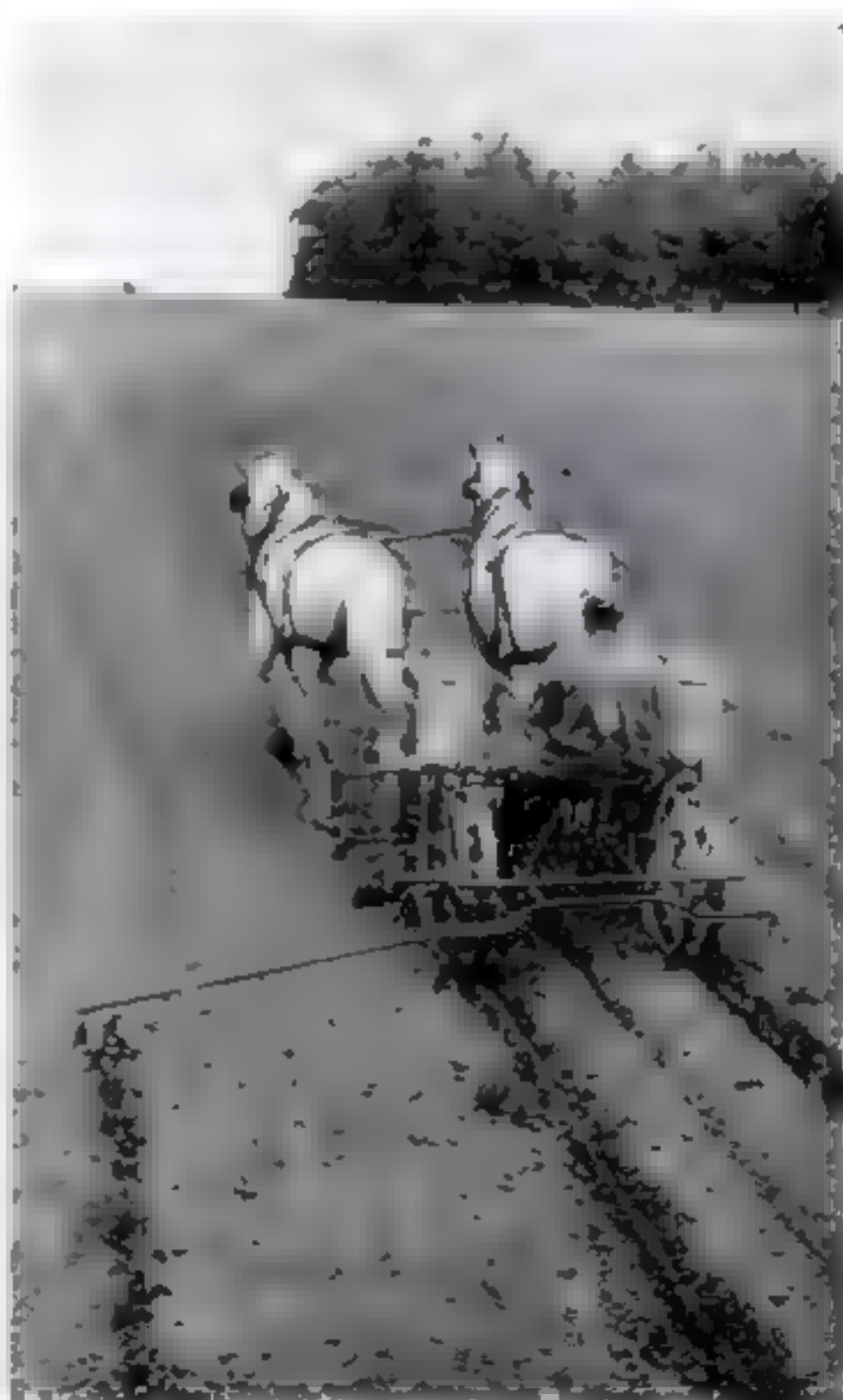
Planting more than the proper amount of seed will likewise reduce the yield as well as increase the costs. Although experience has shown that up to a certain point an increase in yield can be obtained by increasing the amount of seed planted, overseeding will defeat that end.

To get a maximum yield of corn, at least three objects must be borne in mind in planting the seed. The proper amount per acre must be planted, the seed must be evenly distributed, and it must be planted at the right depth. All of these considerations should influence the testing, adjustment, and operation of planters. Plates must be selected according to the size and shape of the kernels, and it is essential that the planter be tested if the proper number of kernels are to be planted unfailingly in each hill.

The essential features of a corn planter are the feed mechanism, which is in the form of a plate with cells or spaces in which the kernels are carried to the outlet into the seed boot; the seed boot and valves for accumulating the desired numbers of kernels for each hill; the release mechanism for opening the valve to permit the seed to drop into the ground; the drive mechanism for operating the planter; and the furrow opener and seed-covering device. The drive mechanism includes shafts, wheels, a checking head, a clutch, sprockets, chains, pawls, and springs. On power-driven planters, there are special drive shafts as well.

Use of a check planter permits the cross cultivation of corn, because it lines the hills up both ways, facilitating effective weed control. The practice of check planting is widely followed in the Corn Belt. Valves in the seed boot are operated by buttons on a check wire stretched across the field. These buttons are spaced the same distance apart as the hills of corn are to be planted.

Corn planters are used only a few days each year, but adequate lubrication and careful adjustment of wearing parts will long delay the time when extensive repairs become necessary. In the annual overhaul clean all parts thoroughly, including the grain hopper or seed box, the fertilizer attachment, if there is one, and the feeding mechanism. Remove and clean all chains with kerosene; then put them in an oil bath. Replace badly worn sprockets and chains with new ones. See that the shafts turn





# Dividends in Higher Yields

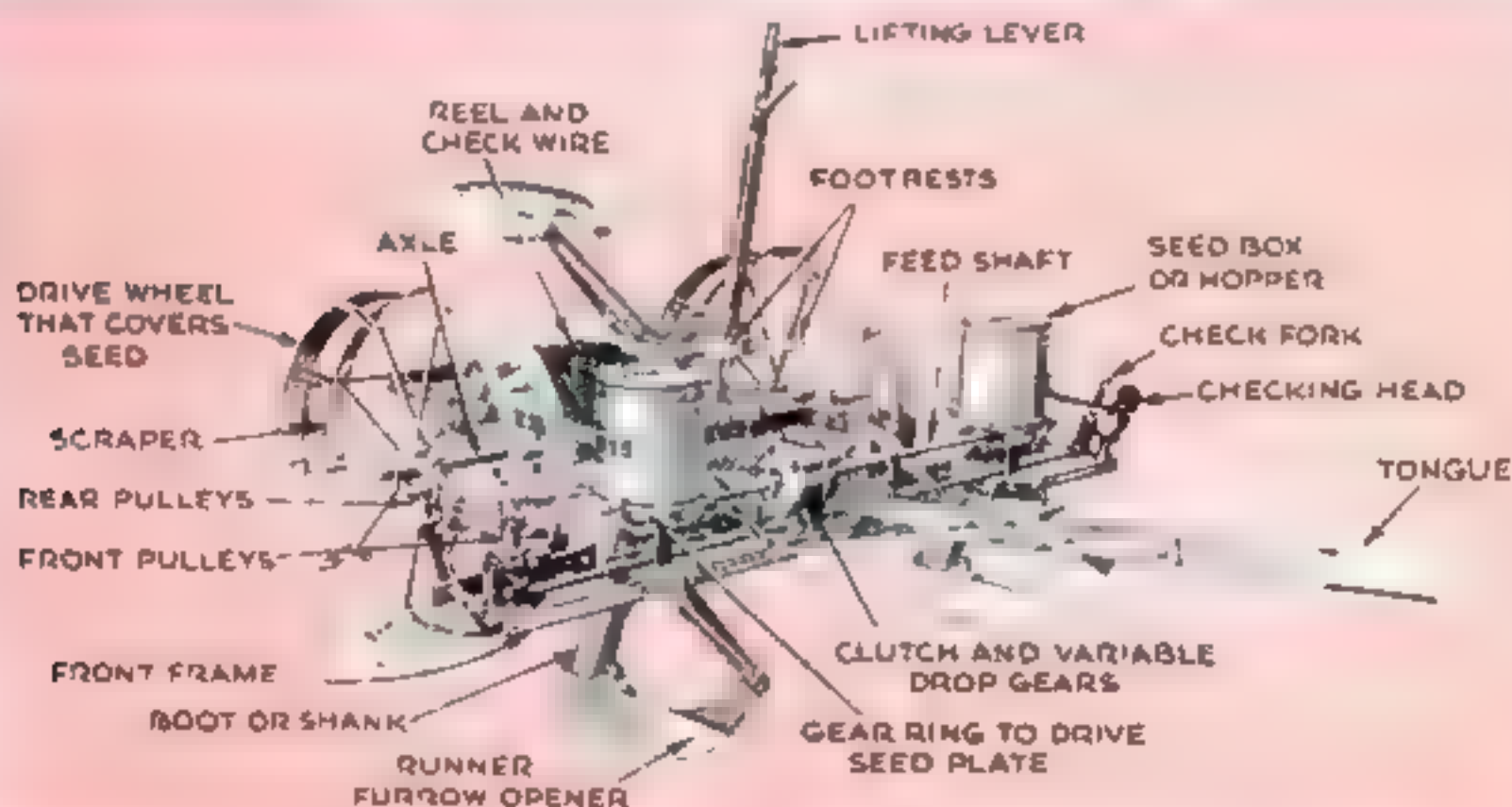
freely. Remove the wheels and make sure that all bearings are clean and well lubricated. Where the feed mechanism is driven through pawls, these should be checked for wear, and the pawl springs should be replaced if weak. It may be necessary to remove the feed shaft and replace loose or worn bearings. See that the feed shaft turns easily and does not bind because of rust or improper alignment.

Carefully test the drop mechanism, and the check head if it is a check planter, replace worn parts, and lubricate all moving parts. Oil the shaft in the feed boot on which the valves pivot.

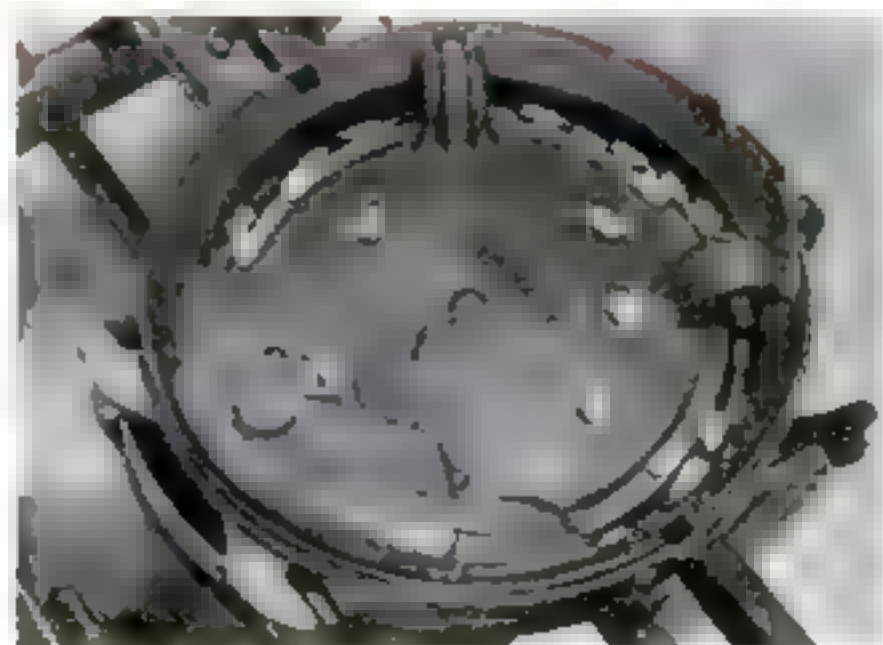
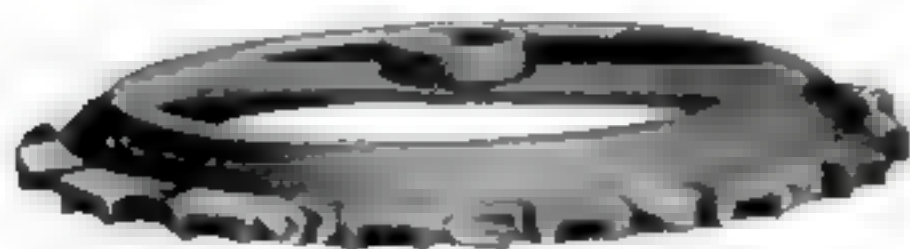
To secure uniform depth in planting, it is essential that the furrow openers be in good condition, and that each furrow opener be tested for loose connections either at the dragbar or at the frame of the machine. Dull furrow openers should be sharpened.

Where disk furrow openers are loose, new bearings should be installed to eliminate uneven planting. Check pressure springs and levers to see that they function properly. See that all bolts are tightened.

Before testing a corn planter, decide upon the amount of seed to plant. Highly fertile soil may take three kernels to the hill; less fertile, only two kernels. When the amount of seed to be planted is determined, the planter should be tested for accuracy of drop. The success of the test will be largely dependent on the seed plates selected to fit the size and shape of the kernels. Most farmers now use hybrid seed corn, and when it is carefully graded so that the kernels are of uniform size and shape, a proper plate for such seed can be selected. In planting, as the plate revolves, one kernel falls into each cell in the seed plate. Special plates may be obtained for planting round-butt



Above, the principal parts of a typical two-row corn planter. The kernels in the picture below illustrate why the plate cells must fit the seed. At right, the seed plate revolving at the base of the hopper selects the number of kernels per hill





kernels, small-tip kernels, large, flat kernels, and small sweet-corn seed.

The rate of planting is determined by setting a lever to accumulate two, three, or four kernels to be dropped in each hill, depending upon fertility. Some planters are built so the change of the number of kernels per hill can be made without stopping the planter. With two valves in the planter boot, one hill of seed accumulates on the upper valve as the hill on the lower valve, close to the ground, waits to be discharged.

To check the accuracy of drop, support the planter on blocks so the drive wheel will be free to turn. Trip the check head while turning the drive wheel and note the number of kernels that are dropped each time it is tripped. The accuracy may be as high as 90 per cent, depending on how well the seed is graded as to size, thickness, and shape of the individual kernels.

Proper adjustment of the height of the

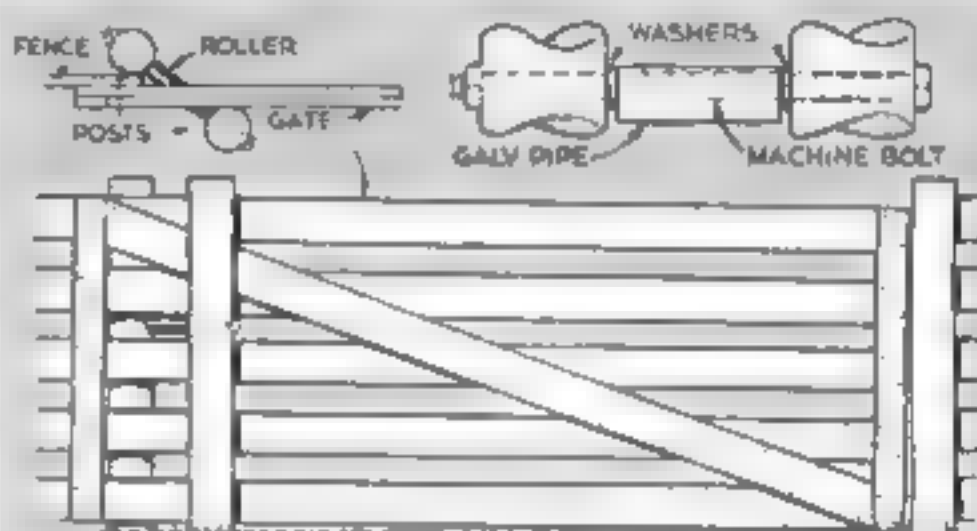
front of the planter is important for accurate checking. If it is too low, the kernels will be dropped a few inches back of the button on the check wire. Raising the front will throw the furrow openers forward and cause the kernels to be carried further before being dropped. Accuracy of checking can be determined by digging up a few hills in the field, marking them with small stakes, and sighting across the stakes.

Actual planting is achieved by the pressure of a heavy spring which causes the opener to penetrate the soil. The depth can be controlled by means of a lever that raises and lowers the furrow openers.

Check planters can be used for drilling corn by setting the planter to give the desired interval between kernels. This can be done by selecting proper seed plates or by changing sprockets. For drilling, lock the valves open with the foot lever, and lower the furrow openers.

## Pipe Rollers Ease Opening of Hingeless Field Gates

A FIELD gate of the hingeless variety may be opened and closed with less exertion if a pipe roller is installed in place of the piece of wood ordinarily used to hold it up between its two posts. Mount a length of pipe on a rod bolted between the posts at a point where the second board from the top of the gate will ride upon it. Grease the roller for easy sliding.—J. K. K.



## FEBRUARY CHECK LIST

[ SHIPSHAPE HOME ]

1. Overhaul poorly aligned door locks and bolts, and readjust hinges on doors that don't shut properly.
2. Clean snow from cellar windows to keep thawing from causing leakage.
3. Tighten bolts on kitchen range, replace missing ones, and adjust the burners.
4. Chisel out and plaster up all cracks in walls and ceilings.
5. Clean out gaps between kitchen fixtures and wall, and apply molding.
6. Remove loose floor tiles and reset in cement or a compound.
7. Scrape out loose filling around bathtub and calk with a waterproof compound.
8. Replace washers and packing in dripping faucets.
9. Fill and calk all crevices between the wall and floors.
10. Inspect first-floor joists and renail loose bridging.

POPULAR SCIENCE MONTHLY SHOP DATA





BUY  
WAR BONDS  
TODAY

# On every fighting front



*The Army Navy "F" flies above four F over points for excellence in aircraft production and from the fathers for tank production, while the Army "F" with four stars, is flown by it & another Fisher point for its outstanding work.*

**T**HE men who do the fighting, whether on land, sea or in the air, know how important it is to have the best equipment.

They realize that the work we do in our factories can, if done well enough, give them a combat advantage.

We realize that, too. That's why we are devoting all the skills we have developed, all the crafts we have mastered, to give our armed forces the all-important edge.

Whether it's a plane, an anti-aircraft gun, a tank, or a highly sensitive flying instrument, each gets every technical plus we can give it — and that's several.

**Craftsmanship is a Fisher tradition. And today we believe craftsmanship carries a particular punch of its own to give a fighting man a break when a break is more than welcome.**

. . .

Every Sunday Afternoon  
**GENERAL MOTORS SYMPHONY OF THE AIR**  
NBC Network



armament  
**BOY BY**



**DIVISION OF GENERAL MOTORS**





## Remember when . . .

*you could buy new tires whenever you pleased?*

**I**T DIDN'T MATTER so very much then if a tire's pressure was a little lower than it should have been.

We didn't worry a great deal if we stopped shorter than we should, and left a few rubber marks on the pavement.

There was nothing terribly wrong about gouging off a little of the tread in showing how fast we could get away from a stop-light.

And, as long as we chose the right time and place, it was no crime to "burn up the road" occasionally for the sheer joy of fast motion.

It's different now—and how!

Every car in use today is a national asset; it must be kept rolling. And every ounce of rubber in its tires is part of our wartime resources—to be cared for, protected against abuse, made to last as long as possible.

That's the reason for frequent tire inspections

—Victory Speed—slow starts and stops—properly maintained tire pressures—careful parking to avoid sidewall damage—and all the other tire-saving precautions you can take.

By doing these vitally important things—not just *some* of them but *all* of them—every American car owner can help in a very real way to make victory more certain and more complete.

★ ★ ★

REMEMBER WHEN your Seiberling Dealer was able to offer you all the brand new tires you wanted? He can't be liberal with tires today, but he can and does come through with the personal service and personal interest you can get only from an INDEPENDENT business man. We at Seiberling believe in the dynamic, creative force of American independence—independence of thought and action, and INDEPENDENCE IN BUSINESS. That is why Seiberling Tires will continue to be sold, as they have been for a generation past, by INDEPENDENT dealers only.

**SEIBERLING** Experts in Rubber

Wartime manufacturers of Bullet-Sealed Tubes and Military Tires for our armed forces • Bullet-Sealing Gasoline Tanks • Rubber Floats, Boats and Pontons • Rubber Parts for Gas Masks, Airplanes and Tanks. Also makers of Tires and Tubes for passenger cars and trucks • Sealed Air Tubes • Rubber Heels, Soles and Mechanical Goods.





# Making Our Soldiers Tough *(Continued from page 60)*

at regular intervals. This determines his muscular strength, agility, endurance, and co-ordination. It's also a sure way to find out the extent of his improvement under training.

Creators of the program simplified the routines to make every movement an effective training device. They gave each exercise in the now famous dozen a name that soldiers can easily remember; they stipulated an exact number of counts, so that motions can be made in cadence and whole drills run off with a minimum of commands.

They named their 12 the high jumper, burpee, squat bender, rowing exercise, push-ups, sit-ups, side bender, bank twist, squat jump, trunk twister, stationary run, and eight-count push-ups. Later, they adopted some alternative exercises, known as the mountain climber, the wood-chopper, and the bridge. Most of these names are descriptive of the motions.

In the high jumper, for instance, the men swing their arms from their sides to above their heads and jump straight up, at least a foot into the air. Then they swing their arms forward and jump in that position, then backward and jump. This is done in rapid cadence, from 12 to 25 times before the men pass on to another exercise at a single command, and without any intervening rest.

Besides the calisthenics, there are drills in which men of approximately the same weight and height may be pitted against each other, individually or in teams. The very names of these describe what they do. They are the hand wrestle, the pull-hands, the wrist bend (or make-'em-beg), the head push, the shoulder push, the back-to-back push, the knock-'em-down, and others.

In the knock-'em-down, for instance, each of two men tries to knock his opponent off his feet in any way possible. Each contestant may tackle, push, pull, lift, or wrestle. The first man who has any part of his body except his feet touching the ground loses.

In developing these exercises, the authors of T.C. 87 did not forget that marching under full field equipment and playing such games as soccer, baseball, pushball, and volleyball are valuable aids to training. They set up some rigorous standards for marching under full pack. Here are some of them:

"March four miles in 45 minutes; march five miles in an hour; march 16 miles in four hours; march 25 miles in eight hours;

march and double-time for seven miles without halt."

Once they were convinced they had worked out an improvement on old Army methods, the physical-education experts made a demonstration test at a camp in California. They took two companies of 250 men each, so equated that each had the same number of men from various sections of the country, from various walks of life, and of various ages. As nearly as possible, these two companies started equal in physical condition. Each underwent a six weeks' training course, under constant observation; the experimental group with the new system of physical toughening, and the control group with the traditional.

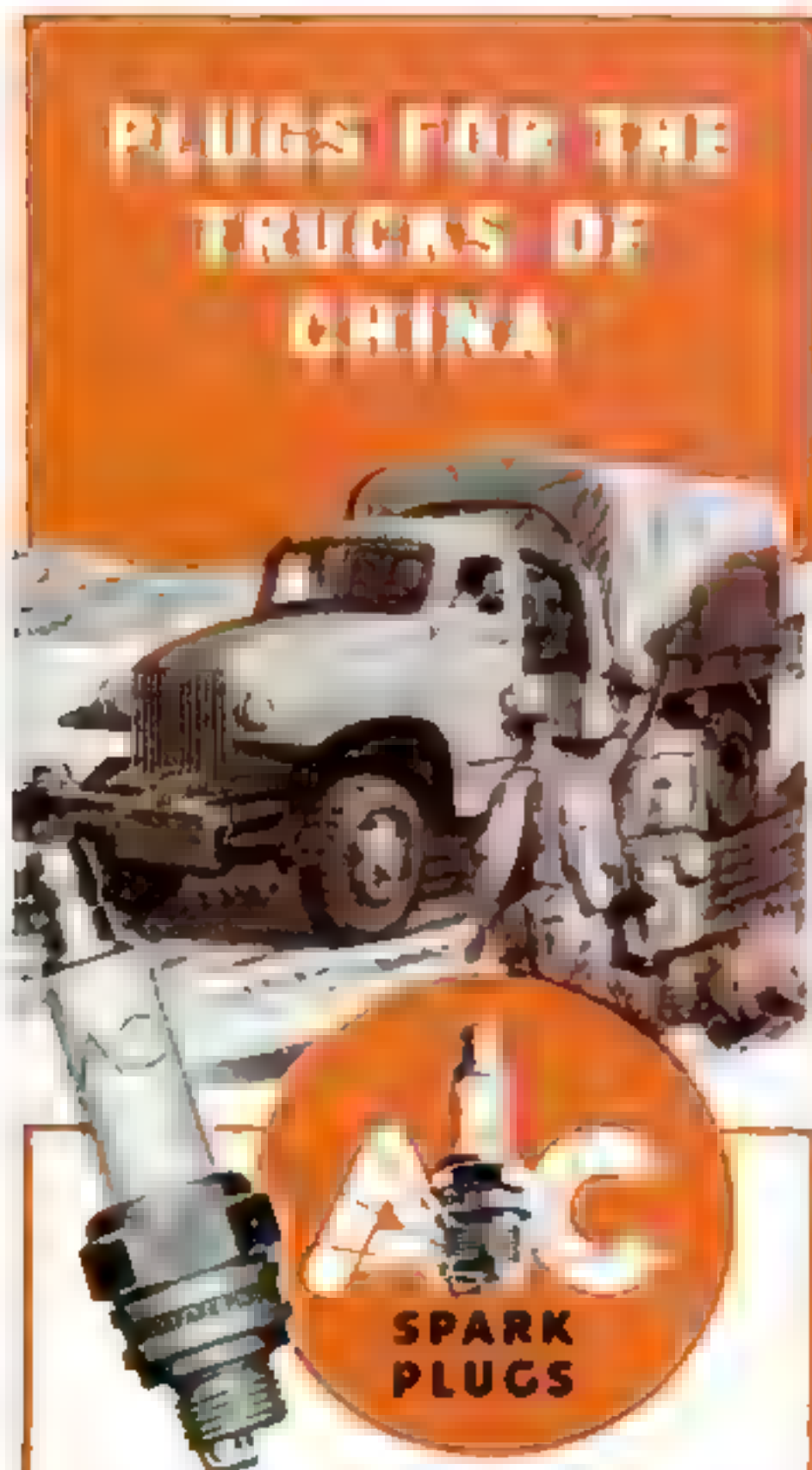
At the start and at the close of this period, every man in both companies received a test in eight exercises. There were pull-ups, push-ups, sit-ups, and three successive standing broad jumps to test their strength. There was the 20-second burpee to test their agility. To test their endurance, each was required to run 75 yards with a man of equal weight on his back, and 300 yards as a sprint. To test their co-ordination, each was put through a dodging run about obstacles. The improvement of each company was measured on a point system. It showed that the experimental group had gained by 23.5 percent, while the control group, under former Army methods, had improved only 3.5 percent.

The average man in the experimental company increased the number of times he could chin himself from 8.3 to 10.8 times. His push-ups increased from 20.4 to 32.2 times. He cut his time for running 300 yards from 51.2 to 47.5 seconds.

Since that test, the Special Service Forces have been gradually installing their system of physical drill and periodic testing throughout the Army, as officers are trained to conduct it. They have worked out some average physical-capacity standards for soldiers according to seven tests, and a point system whereby every soldier can see where he stands in comparison with his fellows. The job of the athletic officers includes stimulating individual soldiers to improve their ratings.

Three periods of training change the raw recruit into a toughened soldier. The first, of six weeks, emphasizes calisthenics. These gradually give way during the second period—from six to 10 weeks—to competitive games. Thereafter is a period of "maintenance of condition."





WHEN you learn of fresh action on the China front, you can be sure that motor trucks from the U. S. A. are "in there—pitching." And, they must get through.

Thousands of the trucks are equipped with the same make of spark plugs, oil filters, and fuel pumps which has served America so well, so long. They wear the AC emblem, which is known as a symbol of good engineering, trustworthy performance, and precision manufacturing.

#### Conservation HERE Means Victory Over THERE

In order that military vehicles, planes, and ships may have all the AC Spark Plugs, Oil Filters, and other products needed, we here at home, cannot have as many.

Let your repair man conserve your transportation by keeping your AC devices in condition. When replacement is necessary, select AC for continued satisfaction.

AC SPARK PLUG DIVISION  
GENERAL MOTORS CORPORATION

BUY WAR BONDS—AND BRING VICTORY QUICKER

## United Nations Flag Quiz

How well do you know the flags of our allies? In each of the statements below, only one of the choices given is correct. Check your results with the answers below. If you do too badly, better go back and study up on pages 92 and 93.

1. Six stars appear in the flag of (a) Honduras (b) Australia (c) New Zealand.
2. Color found in the greatest number of flags is (a) red (b) white (c) blue.
3. Named on its flag is (a) Mexico (b) Iran (c) Nicaragua.
4. The globe appears on the flag of (a) Poland (b) Brazil (c) South Africa.
5. Green is predominant in the flag of (a) Mexico (b) Haiti (c) Costa Rica.
6. A white cross is the symbol of (a) Yugoslavia (b) Luxembourg (c) Greece.
7. Written words are on the flag of (a) Canada (b) Czechoslovakia (c) Brazil.
8. The sun shines from the flag of (a) India (b) Australia (c) Norway.
9. Fleur-de-lis of France appears on the flag of (a) Luxembourg (b) Belgium (c) Canada.
10. Three horizontal bars, red, white, and blue, make up the flag of (a) Ethiopia (b) Netherlands (c) Panama.
11. A bird is found on the flag of (a) Panama (b) Iraq (c) Poland.
12. There's a lion on the flag of (a) Australia (b) Iran (c) India.

### ANSWERS

1. c 2. b 3. a 4. b 5. a 6. c 7. a 8. a 9. c 10. c 11. a 12. b

## Home and Workshop Index for Your 1943 Issues

Your back copies of POPULAR SCIENCE will be more valuable, and the wealth of material in them will be readily at your finger tips, when you have a copy of the new Home and Workshop Index. It lists all articles that appeared from March 1943 through December 1943, on home repairing, chemistry, craftwork, model making, wood-working, radio, automobiles, and new shop ideas—alphabetically arranged and cross-indexed for convenience. Send a dime to Popular Science Home and Workshop Index, 353 Fourth Avenue, New York 10, N. Y., enclosing a stamped, self-addressed No. 10 (legal size) envelope. A limited number of 1942 indexes are also available; send 20 cents if you wish both.



# EVERLASTING TEAMWORK

The Story of  
Ernest E. Charlton



**ERNEST CHARLTON** wanted to become a banker. But today he's managing millions of volts instead of millions of dollars!

During his last year at Grinnell College, Iowa, the offer of a scholarship in chemistry at the University of Illinois changed his mind about banking. At Illinois he also studied physics and engineering, played semi-pro baseball, taught undergraduate classes—and came out with a Ph.D., a stack of Liberty bonds, and a job with a New Jersey chemical company.



Before long he was offered a position as chemist in General Electric's Research Laboratory. There he coaxed the rebellious metal caesium into the vacuum tube, helping to pave the way for development of photo-tubes for modern movies and television. His success in working with electron tubes led to his appointment in 1929 as head of the X-ray section.

And then the real fun began! He and his colleagues began developing tubes for higher and higher voltage X rays. One was the 1,000,000-volt Cyclops eye that sees through

inches of steel the way the human eye sees through glass. Then came the development of the newly-born "betatron," in which a 2,000,000-volt infant has grown first to 20,000,000 and now to 100,000,000 volts. With this growth it produced electrons of higher and higher energy and X rays of higher and higher frequency. What such radiations will accomplish no one yet knows—but then, Dr. Charlton believes, that's the fun of research!

He also believes that the problems of research are solved not so much by individual effort as by the everlasting teamwork of the scientists. Learning through failures, trying again and again until you get the solution—that means success not only in research, but in life.

A golfer of tournament status, Dr. Charlton is now too busy with secret war work to cover the links except sometimes on Sunday morning. But he's one of the players in the All-America game of beating the Axis! General Electric Company, Schenectady, N. Y.



Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday, 10 p.m. EWT, NBC—"The World Today" news, every weekday, 6:45 p.m. EWT, CBS.

192,000 employees of General Electric are buying over a million dollars of War Bonds every week.

**GENERAL  ELECTRIC**

DA-37K-211



# POWDERED METAL *helps* ... *and* SPEEDS



**FROM POWDER  
TO GUN PART IN  
*22 Seconds!*  
(200 TIMES FASTER)**

From metal powder so fluffy that a good puff of breath will blow it away, Chrysler Corporation is today turning out parts of most intricate shapes to precise measurements. Some of them are actually so tough that they will even cut glass.

Back in the late twenties Chrysler Corporation Engineers developed and its Amplex Division began to produce heavy duty oil-cushioned bronze bearings. The experience gained in this interesting and economical way of manufacturing is now saving precious time, strategic metals and releasing machine tools and men for other war work.

Chrysler Corporation produces hundreds of thousands of powdered metal parts every month for the Nation's superior weapons of war.

WAR BONDS ARE YOUR  
PERSONAL INVESTMENT  
IN VICTORY

## CHRYSLER

AMPLEX • PLYMOUTH • DODGE



# *build* SUPERIOR WEAPONS WAR PRODUCTION



## Powdered Metal Parts Save Both Metal and Man Hours

This anti-aircraft cannon uses 106 different, solid or oil-impregnated parts made from powdered metal. Over a 12-month period, the use of

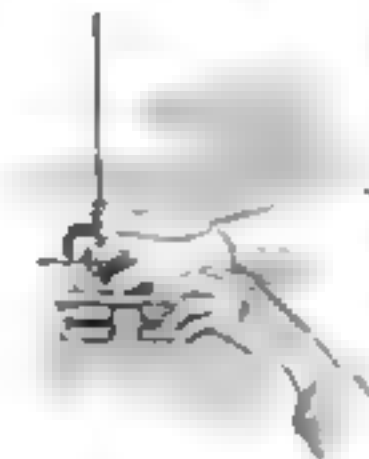
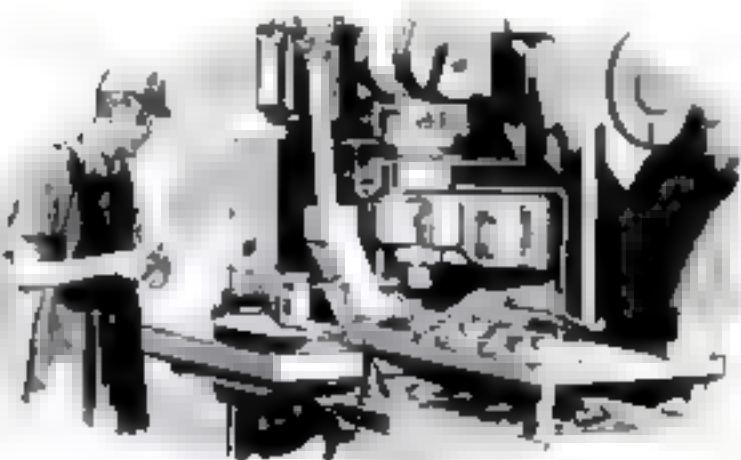
powdered metal parts on this weapon instead of originally designed solid metal parts, alone released 8,000,000 man hours and 1,250,000 pounds of metal for other war tasks. As an example of metal saving, a 20-pound part requires only 20 pounds of powdered metal; whereas, in standard manufacturing practice, losses in machining sometimes range from 20 to 75 per cent.



## Oilite Solves Many Lubrication Problems

Self-lubricating Oilite bearings in engines and controls, help fast climbing aircraft get

"upstairs" in a hurry. Functional problems caused by quick and extreme temperature changes from ground level to high altitudes are often solved through the use of countless Oilite bearings which are practically "fool-proof" in operation. Some bombers contain more than 2,000 powdered metal parts made by Chrysler Corporation.



## New and Fine Degrees of Precision are now Attained

Chrysler Corporation produces, in quantity, micrometer frames, tool makers' vee blocks harder than glass, gauge units and other instruments capable of accuracy greater than one ten-thousandths (0.0001") of an inch.

Making such precision instruments was formerly a slow, painstaking task. Now they are "pressed out" in a matter of seconds, 75 per cent complete.



## Big Parts Developed for War Machines

Engineers, metallurgists and powdered metal production men of Chrysler Corporation have definitely disproved the belief that some large and

heavy parts could not be made from powdered metal. Where a part weighing three pounds was a pre-war maximum, Oilite bearings twenty times this size are now being made.

## From Peacetime Research Have Come Developments that Solve Many War Production Problems

Remember the days when you could first forget about oiling the vacuum cleaner or refrigerator or the clutch bearings on your automobile? This was only the starting phase of great development in the field of powdered metal manufacturing. In its production of many thousands of different war weapon parts, Chrysler Corporation, a pioneer of *heavy duty* and *large* powdered metal units, has brought a fast, economical metal-and-manpower-saving means of manufacture to major war industries.

Tune in Major Bowes every Thursday, CBS, 9 P. M., E. W. T.

# CORPORATION

DE SOTO • CHRYSLER • AIRTEMP



# SPEED MACHINE SAW FILING with Nicholson File Holders (POINT AND TANG HOLDERS)



They simplify rotating, removing, replacing and positioning of file.

**NICHOLSON** File Holders for repetitive filing are a great improvement over methods which involve infinite making and undoing of adjustments. No hand-and-hammer wedging of file into holders! No "unwedging" or loosening of set screws to turn or remove file! No repeated hand gauging! Note this simple, methodical procedure:

**INSERTING FILE.** Push back spring plunger of point holder. Insert tang. Triangular socket engages file at precision-formed surface, not at less accurately forged tang. Insert point; release plunger. Position file; tighten set screws. Once done it—for entire job.

**TURNING FILE.** Push file forward to disengage shoulder end. Rotate file for fresh cutting edge. Release plunger; file springs back. All set to go again!

HOLDERS available for every size triangular file. COMBINATION BRACKETS to fit all standard saw-filing machines—Anderson, Cleveland, Foley, Seigmeister, Wardwell, etc. Consult any mail-supply house handling Nicholson or Black Diamond Files—or write us direct.

Nicholson File Co., 18 Acorn St., Providence 1, R. I., U. S. A.  
(Also Canadian Plant, Port Hope, Ontario)

**NICHOLSON  
FILES** FOR EVERY PURPOSE  
NICHOLSON  
U.S.A.  
MADE IN U.S.A.

## I Fly "Mitchells"

(Continued from page 73)

make co-ordinated 15-degree turns, right and left. I'll bet gunners on the ground developed some Nazi version of the jitters, trying to cut their fuses accurately and guess what we'd do next. They couldn't figure both range and deflection accurately while we were galloping like wild colts across the sky.

At first we carried small, close-cover fighter escorts, usually six P-38 Lightnings. They hovered 1,000 feet above us like eagles, ready to beat off the hawks. As our flights grew larger, until 100 or more mediums would set off in formation, protected by half a hundred Lightnings, we revised our tactics. You can't hide large numbers of bombers from an alert enemy during day-time sweeps. When large masses of bombers take off, they often rendezvous at bombing altitude above their own field and set out on course for the target. When in enemy territory, we took slight evasive action, weaving and changing altitude en masse. For 30 seconds we would fly level, drop our stuff, climb sharply to throw the gunners off, dive to 5,000 (picking up an extra precious 40 miles an hour), and high-tail for home.

For a time after losing *Miss Mary Jane*, I piloted *Cordelia's Bob* (*Cordelia* being my mother's name). Her hydraulic and electrical systems shot out and the right rudder gone, she washed out in a crash landing at Telergma one day. That's not a very exciting tale, but *Cunningham's Coffin*, my third Mitchell, came within an ace of living up to the name I bestowed upon her.

May ended the African campaign, but the Kasserine Pass break-through had not developed when the high command called upon us to sweep the Mediterranean. Daily our planes would sweep Mussolini's *Mare Nostrum*, covering an 800-mile area between Sicily, Sardinia, and Tunisia. We flew usually in flights of 18, ready to take on German fighters or break into elements of three to attack individual ships in Africa-bound convoys. Large tankers and transports rated triple-A priority, and if possible we came down out of the sun to make sure they got it.

Rommel's supply corps strove desperately to get fuel and other materials to him, especially high-octane gasoline for his dwindling air force and tanks. One day while the Kasserine Pass battle raged, our Intelligence reported a tanker was due to leave Sicily shortly, bearing 1,000,000 gallons of gas. Briefing had scarcely begun when we knew this was a "must get" deal.

(Continued on page 210)



TOUGH... BUT OH SO GENTLE

# Keep it Sweet!



★ IT'S A  
PRIVILEGE  
TO BUY  
WAR BONDS

★ A sweet running car is music to the ears. It means the motor is operating efficiently; that it will last for a long, long time. That's mighty important these days when a breakdown may leave you without a car, indefinitely.

It's simple to keep your motor running sweet when you watch it carefully and

get it to your motor service man—before it goes sour.

At the first sign of ring failure, have him install a set of Hastings Steel-Vent piston rings. They stop oil-pumping, check cylinder wear, and restore gasoline economy.

HASTINGS MANUFACTURING COMPANY, HASTINGS, MICH.  
Hastings Mfg. of Canada, Ltd., Toronto

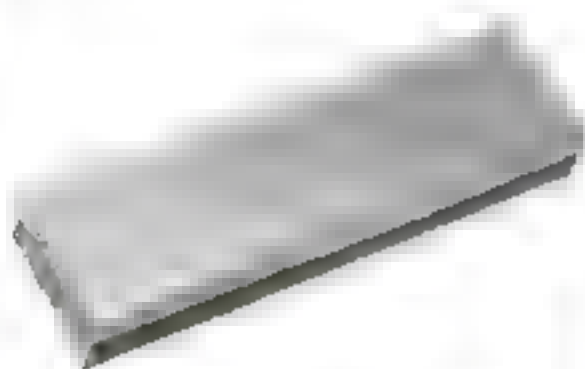


*Tough on oil-pumping  
Gentle on cylinder walls*

## PISTON RINGS



# HOW TO KEEP TOOLS SHARP



## 1. USE THIS STONE!

A Carborundum Brand Silicon Carbide Combination Sharpening Stone gives tools the edge that results in better work. It'll also help make your tools last! One side is of coarse grit for dull tools. The other is of very fine grit for that smooth, keen, fast-working finished edge. Ask your dealer for Carborundum Brand Silicon Carbide Sharpening Stone No. 109.



## 2. WRITE FOR FREE BOOK!

A lot of us realize the importance of sharp tools for good work. But many don't know how to go about it. If you want to know the best ways to sharpen planes, chisels, draw knives, etc., write today for your free copy of "Short Cuts To Better Work For The Home Craftsman." It's full of practical, tested methods of sharpening home workshop tools.

**CARBORUNDUM**



Dept. S-24

**THE CARBORUNDUM COMPANY**

REG. U. S. PAT. OFF.

Niagara Falls, N. Y.

(Carborundum is a registered trade-mark of and tool-cutting manufacturers by The Carborundum Company)

# I Fly "Mitchells"

(Continued from page 208)

We swept out in three-plane elements, scouting widely south and east of Sicily. At 4:30 in the afternoon, immediately off the Sicilian coast, Art Canham, flying the lead plane of my flight, wagged his wings, signaling a suspicious movement somewhere on the horizon. Soon Art dipped sharply to the right, sending Morry Miljius off to paste a light cruiser, while Art and I took on the tanker. We ignored three destroyers, now opening with all their AA guns in a desperate effort to drive us away.

Art and I dived from our searching altitude, 500 feet, to 10 feet, picking up speed to help carry us more quickly through the streaming flak. Luckily, the sun was exactly behind us, and we rolled in for a three-quarter angle of attack. I had no time to be thankful then for the low ceilings down Burma way that led to the development of skip bombing. I felt certain one of us would get that wallowing tub, unless they got us during the next few seconds, needed for the last two miles of approach.

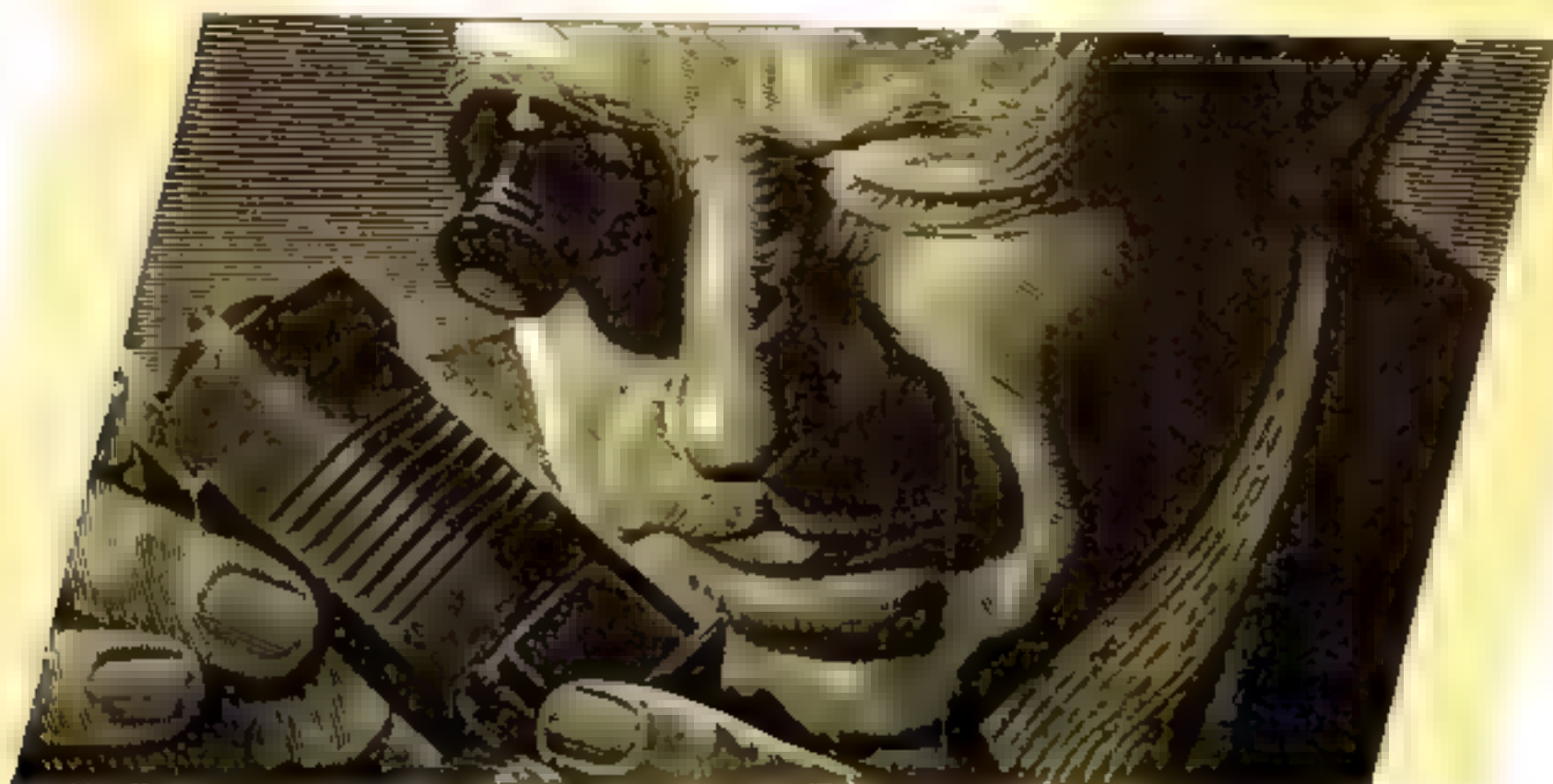
Red-hot rivets were pounding us in the face now, splattering into the engines, wings, and fuselage. To escape them, we took violent evasive action, flying now wing tip to wing tip, again spreading out, skidding in and out, diving and zooming. About three city blocks from the tanker, we came together for the final run and 500 feet out from that inflammable cargo turned loose three 500-pound bombs each. One of mine skipped, struck the near side, and exploded below the water line; the second smacked into the deck, where it gutted the vessel amidships, firing her precious cargo. The third fell harmlessly over. One of Art's smashed into the deck, and two carried over, one close enough to spring the plates. She was perfectly bracketed! That night the gas was still flaming, giving our boys a nocturnal check point as they roared by to bomb Sicily.

Cunningham's Coffin? Not this time. Not quite, though the Mitchell almost carried me to a Davy Jones grave. We were a quarter mile distant when the bombs, carrying four-second-delay fuses, went off. In this incredibly short time, I learned that we were in serious trouble. Flak had shot out my port engine—and, to make matters desperate, its feathering mechanism as well. Other blows from 20-mm. explosives had torn out the gas tank, which now was hanging and flooding gasoline. "One spark," I remember thinking, "and we're goners." I glanced

(Continued on page 214)



# Who can use this after the war?



**S**O far this is definitely a war baby. It was born to meet an exacting wartime need. Every one that is made goes right into the fight.

It is an electric motor designed for jobs which no regular electric motor could fill.

The jobs are on America's fighting planes. Working control flaps—opening and closing cooling shutters—lifting landing gears—and the like.

Every ounce on an airplane is precious. So usual electric motors were out.

This one weighs as little as 8-tenths of a pound—others can move as much as 35 tons.

Naturally it took a whole new

kind of engineering to make this motor.

It took new ideas from the drawing board up. It took new materials—like glass-insulated wire—to build it. It required finer, more precise craftsmanship than had ever gone into a motor before.

After the war, these motors can be sold to manufacturers of peacetime products.

That is why we are telling you about them now.

You may have need for such a compact, ultra-efficient source of power. You may be able to use the kind of engineering thinking that developed it—or the production technique that builds it and about 250 other Lear Products.

**PLANTS:** Piqua, O., and Grand Rapids, Mich. **BRANCHES AT:** New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.





There's been  
a  
big change



JUST as the rhumba replaced the polka, "cageless" roller bearings have found their place in the more exacting world of today.

Tyson's "All-Rolls" design startled bearing manufacturers. "It can't be done," they declared . . . But Tyson

did it—perfected a tapered roller bearing with *thirty percent more rollers*.

And with these extra rollers, Tyson established a new maximum in bearing efficiency—greater load-capacity, more strength and rigidity, longer life. *The big name in bearings today is...TYSON!*



TYSON BEARING CORPORATION, MASSILLON, OHIO

COUNT THE ROLLS • THE ROLLS COUNT

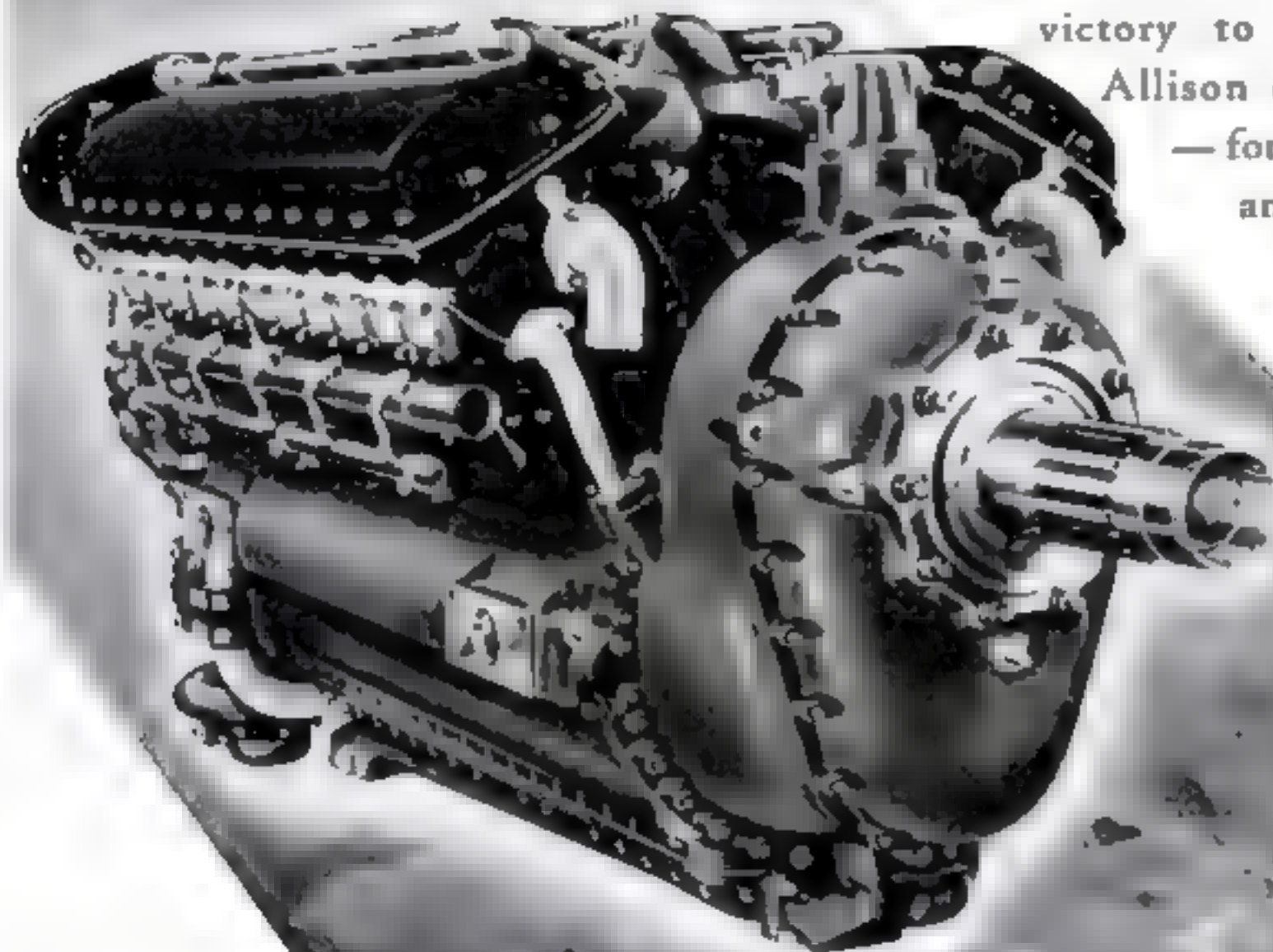
**Tyson**  
TODAY'S HEAVY-DUTY BEARING

★ BUY MORE WAR BONDS ★



# THE ENGINE THAT IS ALWAYS THERE

Allison-powered planes have been called upon  
in every major engagement in which our  
Army has taken part. ★ They have  
had a hand in every great land  
victory to our credit. ★  
Allison engines always  
—for dependability  
and brilliant per-  
formance!



Every Sunday Afternoon  
GENERAL MOTORS SYMPHONY  
OF THE AIR - ABC Network

LIQUID-COOLED AIRCRAFT ENGINES

# Allison

DIVISION OF



POWERED BY ALLISON:

P-38 - Lightning • P-39 - Airacobra  
P-40 - Warhawk • A-36 and P-51 - Mustang

KEEP AMERICA STRONG  
BUY MORE WAR BONDS

FEBRUARY, 1944

Buy War Savings Bonds and Stamps regularly.

213



When You Need a New Saw...



ASK FOR AN  
**ATKINS**  
FIRST!

▲ When you need a new saw, make it an Atkins... you will be getting a saw that will serve you for the duration and many years after.

That's because these Silver Steel Saws have keener, longer lasting cutting edges. Each saw is engineered for speed and accuracy on the kind of work for which it is intended. Ask your dealer if he can supply you with an Atkins.

Atkins "How To Do It" Book—Only 10c Full of helpful hints on the use and care of Saws. Send for yours today.

**E. C. ATKINS AND COMPANY**  
428 South Illinois St., Indianapolis 9, Indiana  
Agents or Dealers in All Principal Cities The World Over



*Silver Steel Saws*

## I Fly "Mitchells"

(Continued from page 210)

again at the dead prop. Friction had turned the hub red hot. Had I been able to feather the prop, we could have made our base easily on one engine. As matters stood, I had no choice. I set *Cunningham's Coffin* down on the smooth sea, 70 miles from home. Seventy seconds later she disappeared beneath the Mediterranean, and 36 hours later a rescue boat came along and picked us up.

More raids followed. I now flew my fourth Mitchell. Unwilling to give her a name for fear she might follow my first three into oblivion, I knew her by serial number only. We bombed Sicilian airdromes and dock installations and supported ground movements. Then came our participation in the first raid on Rome. Fortresses and Liberators touched off this show with a high-level precision attack on the two bottleneck railroad centers. Two waves of Mitchells followed 90 seconds later, striking the Littorio targets.

Rome was little more than another raid to me. Flak was inaccurate and weak. I shall remember forever my ride over those marshaling yards, for Rome was the last enemy city I was to look down upon. My last raid before coming home.

I checked my log when I landed that afternoon. Fifty-two missions... 165 combat hours. Except for a single leg wound (I was hit over Gabes), from which I already had recovered, I was sound as the proverbial dollar.

My mind went back to my Fortress tour of the Ruhr. That day, nearly a year earlier, I had said to myself:

"I'm responsible for the safety of a valuable airplane and four other men. The Army has trained me well. Now, have I got the guts to take them into combat and the skill to bring them out again with their lives?"

I looked across the apron at four men walking away from our last combat landing.

There went Lt. Gerry Upchurch, the "Old Sock" of the outfit and a good-enough bombardier for any air crew. Lt. Jay "Eight Ball" Colvin, the Houston, Tex., boy who had navigated us home from many long flights, ambled after him. Tech. Sgt. Frank Lockhart of Pittsburgh, Pa., our radio operator, and Staff Sgt. Elvin Davis, who lived in Tacoma, Wash., before climbing into our upper gun turret, trailed heavy-footed in the rear.

Our last combat! We had come through hell together.





*"We are proud to pay tribute to the added efforts of our employees which have made Defoe's war record possible. Industrial know-how, plus willing workers, will win the war and assure an even greater post-war America."*

HARRY J. DEFOE  
Founder, Defoe Shipbuilding Co.

## *From Sugar Beets*

## **TO WARSHIPS**

**F**OOD and warships are vital weapons. So forty-seven per cent of the employees at Defoe not only do a full stretch of work in the shipyards, but operate their own farms as well. These farmer-workers are helping to beat the Axis by building warships and also by producing bumper yields of sugar beets and other crops.

They typify the spirit of extra accomplishment which is responsible for our record-breaking production of destroyer escort ships to help crush the U-boat menace.

*The unique Defoe method of building these 1700-ton ships upside down and then rolling them over to complete their construction has doubled man-hour production. This enables twice as many*

*destroyer escort ships to be built at half the labor cost per vessel.*

Independent of government financing, Defoe is building DE ships for the Navy on a fixed-cost basis. This program is not only saving the government millions of dollars, but priceless days in delivery time.

When the Axis is defeated, the peace-time application of our organization, war-born technical experience and advancements will provide products of better quality and at lower cost for the American consumer.

### **BACK THE ATTACK—BUY WAR BONDS**

Defoe workers take more than 10% of their pay in War Bonds.

DEFOE SHIPBUILDING COMPANY,

BAY CITY, MICHIGAN



*Three White Star Renewal Citations now decorate the Navy "E" Award won by Defoe workers.*

**Ships for Victory  
Servants for Peace**





## YOU'VE GOT TO BE GOOD...

You'll be up there in good company when you fly with the A.A.F.!

You'll be on the same team with fighters who knocked out the Luftwaffe over Salerno . . . with bombing crews that blasted Schweinfurt and blew Ploesti off the map . . . with hunters who tracked a Jap fleet to the Bismarck Sea, and bagged every ship that flew the red-ball flag.

You'll be up there in the "big leagues" . . . and to make it, you've got to be good . . . and that puts it up to you!

If you think you've got what it takes to fly . . . if you're willing to work long hours, on the ground as well as "upstairs", . . .

Then maybe you, too, can win your wings as Bombardier, Navigator or Pilot . . .

And fly and fight with the A.A.F. . . . the greatest team in the world!



### MEN OF 17...

Go to the nearest Aviation Cadet Examining Board; see if you can qualify to join the Air Corps Enlisted Reserve. If you qualify, you will receive

the Enlisted Reserve insignia . . . but will not be called for training until you are 18 or over.

Begin now to prepare yourself, mentally and physically, to be a Bombardier, Navigator or Pilot in the A.A.F. Bone up on math, physics, history, geography . . . all important subjects for a member of the Air Forces. Above all, *study hard* . . . and keep your mind alert. For the A.A.F. wants your training as an Aviation Cadet to be second to none in the world . . . so that when you win your wings, you'll be the toughest and *smartest* flyer who ever burned up the sky!

Toughen your body, too. For, as a member of a bomber crew or a fighter pilot, other men will depend on your "staying power," and you will depend on theirs. Meanwhile, see your local Civil Air Patrol officers about taking C.A.P.



Cadet training — also see your High School Principal or Adviser about the recommended courses of the Air Service Division of the U. S. Victory Corps. Both afford valuable pre-aviation training.

### TO WIN YOUR SILVER WINGS...

You'll start your A.A.F. training in one of America's leading colleges (after a brief conditioning period). Here, in 3 months, you will be given the equivalent of a year of college training. From the College Training Detachment you will go on to 8 months of full flight training.

When you win your wings as a Bombardier, Navigator or Pilot, you will get an extra \$250 uniform allowance . . . and your pay will be \$246 to \$327 a month.

And after the war you will be qualified for leadership in the world's greatest new industry—Aviation!

See your nearest Aviation Cadet Examining Board—or the commanding officer of the College Training Detachment nearest you—for complete details.

(Enlisted workers in War Industry or Agriculture—do not apply.)

### U. S. ARMY RECRUITING SERVICE

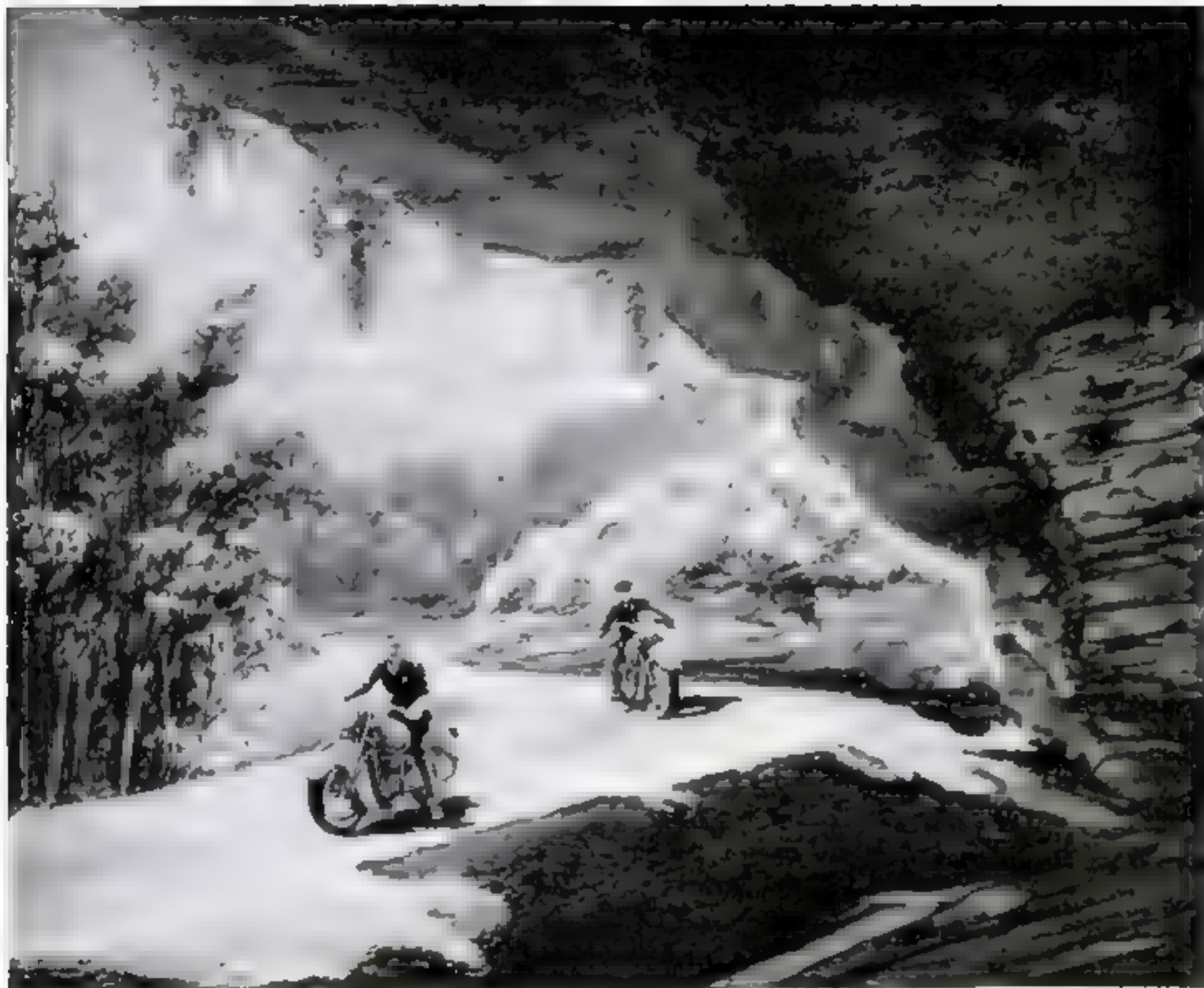
For more information see local Aviation Cadet Examining Board

For information regarding Naval Aviation Cadet Training, apply at the Naval Aviation Cadet Selection Board in any office of Naval Officer Procurement or at any Naval Recruiting Station; or, if you are in the Navy, Marine Corps or Coast Guard, apply through your commanding officer. This advertisement has the approval of the Joint Army Navy Personnel Board.

**FLY AND FIGHT WITH THE**

**GREATEST TEAM IN THE WORLD**





INDIAN  
TRAIL BLAZERS



## *Voyager of Discovery*

Make your voyages of discovery to America's scenic wonders on an Indian Motorcycle. No other form of transportation can wing you so easily and economically to hard-to-reach places. Your Indian seems part of you as it flashes effortlessly...with unbelievable smoothness...over thrilling miles of highway and byway. In the saddle of this modern mustang you ride with confidence and safety...with the glorious wind of freedom on your face!

Look forward to the day when you and your Indian can go adventuring together in a peaceful America.

### INDIANS ON THE WARPATH

Right now, all new Indian Motorcycles go straight to war, and what a fighting record they're turning in! But new, improved, postwar Indians are already being blueprinted. *They're the motorcycles to wait for!*



**BUY WAR BONDS NOW  
TO BUY AN INDIAN LATER**

Indian Motorcycle Company  
Springfield, Massachusetts

Mail FREE copy of exciting Indian News.

Name.....

Address.....

City.....State.....

# Indian

## MOTORCYCLES

FEBRUARY, 1944

Buy War Savings Bonds and Stamps regularly.

217



FOR ACCURATE BOLT TENSION

## Snap-on TORQOMETERS

... MAKE CORRECT TENSIONING  
EASY AS READING A WATCH

Even veteran mechanics can't be expected to *guess* correct bolt and stud tension . . . or estimate even close to uniform accuracy. But with a Snap-on Torqometer you can hit the specified pressure *every time* . . . right to the correct inch-pound or foot-pound . . . and do it swiftly and confidently! You *see* the pressure as the nut is turned . . . easy as reading a watch!

On line assembly and maintenance operations, Snap-on Torqometers insure precision, eliminate the danger of mechanical distortion. As easy to use as an ordinary wrench. Available in a full range of capacities, from 150 in. lbs. to 2,000 ft. lbs.

SNAP-ON TOOLS CORPORATION  
KENOSHA, WISCONSIN



## Burma Is No Paradise

(Continued from page 66)

and much of Africa, joined the conversation and echoed these statements, having been a victim of Burmese malaria himself. Knowing how tough it can be when one has to "walk out" of Burma into India, as a number of his friends had to do, he designed a belt of essential supplies, which he wore constantly.

First of all, he had his pistol, but more important was his compass and his knife with a 14-inch blade. "Don't consider a knife with less than a five-inch blade," said the Captain, "and one with a 16-inch or 18-inch blade is not oversized."

In an empty canvas first-aid kit he kept 50 five-grain quinine tablets for malaria—about two months' supply, because the walk back frequently took that long. In addition, he carried about 20 sulfaguanidine tablets for diarrhea or amoebic dysentery; and 20 sulfathiazole tablets for throat infections and abrasions of one kind or another. And, of course, he carried the usual first-aid kit on his belt. For building fires for cooking and boiling water to drink, he had a cigarette lighter tucked away, with flints and fluid.

"The pistol," the Captain explained, "was necessary for protection, but it was never meant for big-game hunting. So I had one of the new carbines fastened on hooks just inside of the door of the plane, where I could grab it the last thing as I bailed out. I didn't weigh myself down with extra ammunition. I thought the single clip in it would carry me out, because the game in the Naga Hills is surprisingly tame. You can all but walk right up on a deer as it stands at a stream drinking."

"But of course," Colonel Scott interposed, "the natives of that area could be counted on to help you, which was the exact opposite of the conditions I faced. Where you were, in the area of the 'triangle' and the Naga Hills, the natives aren't Burmese, but descendants of the Tartars who came there centuries ago under Ghenghis Khan.

"The Tenth Air Force in India had offered the equivalent of \$30 for every American soldier rescued by these mountain peoples. To them, that is a munificent reward, which has turned head-hunters into guides. Injured flyers have been carried 50 and 75 miles in litters through the jungle to safety.

"Even at that, you mustn't make any sign or movement that the natives could construe as hostile, or you're a clay pigeon. If they ask for your gun, give it to them. It would offer only temporary protection, anyhow, against a tribe of wild men."





## WHY DO WE SAY "ELASTIC"?

This is an Elastic Stop Nut.  
You know it by the red collar.  
That collar is plastic—and  
elastic.

This is why the Elastic Stop Nut  
is different from other nuts.

When this nut is put on, the bolt  
threads press into the collar. It  
more than fits—it squeezes.

The nut can't wiggle, turn and  
loosen. It locks and holds tight  
—anywhere on the bolt.

Being elastic, the collar "comes  
back" after the bolt is removed.  
So Elastic Stop Nuts can be  
used over and over again and  
still lock.

Billions of Elastic Stop Nuts  
are being made today. And to  
our knowledge, not one in a  
million has ever failed.

After the war these self-locking  
nuts will make hundreds of  
things you buy safer, stronger,  
more durable. So watch for  
that distinctive red collar—it's  
the mark of these unusual self-  
locking nuts made by Esna.

# ESNA

TRADE MARK OF  
ELASTIC STOP NUT CORPORATION  
OF AMERICA

## ELASTIC STOP NUTS

*Lock fast to make things last*  
Union, New Jersey and Lincoln, Nebraska



## WHERE ELASTIC STOP NUTS ARE GOING NOW



There are more Elastic Stop Nuts  
on America's planes, tanks and  
naval vessels than all other lock  
nuts combined. More than 12,000  
of them go on the P-47 Thunder-  
bolt. Two important applications  
show in the picture above.

1. Just four Elastic Stop Nuts  
fasten the fittings that hold  
each wing.
2. Just four bolts held secure  
with Elastic Stop Nuts fasten  
the throbbing 2000-hp.  
Pratt & Whitney engine onto  
the ship.



# Ingenious New Technical Methods

Presented in the hope that they will  
prove interesting and useful to you.

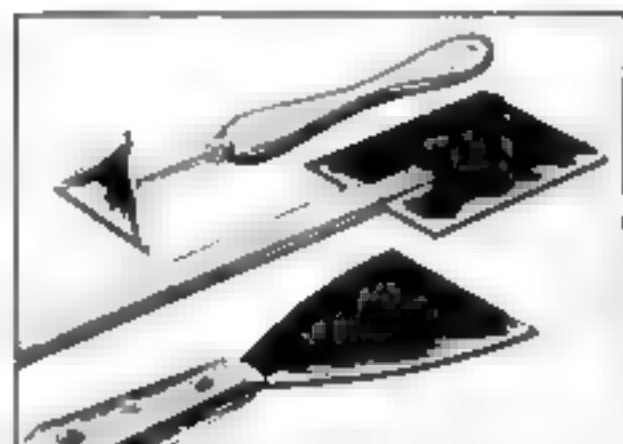


## Beryllium Copper Bites Into Steel

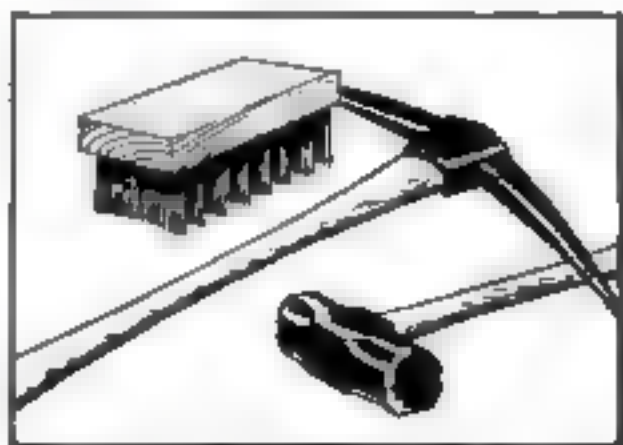
It is an old saying that when a dog bites a man it is not news, but when a man bites a dog it is news. That being the case, it is certainly news when copper bites into steel. Copper is, of course, one of the softer metals but when 2 per cent beryllium is added to copper, its characteristics are changed. The alloy is heat treatable which explains the remarkable strength and hardness. Hit a chisel made of Beryllium Copper with a hammer and it will bite into steel without dulling the edge. Tools made of Beryllium Copper are non-sparking and therefore are used in ordnance plants, oil refineries and other places where explosions may occur from sparks off steel tools. Tensile strength as high as 200,000 lbs. psi can be obtained with Beryllium Copper; hence, it is used for many applications where resistance to high loading and impact fatigue are important, such as airplane motor bushings. Most of the critical springs and diaphragms used in aviation, Navy and Signal Corps instruments are made of Beryllium Copper because of its reliability as a spring material.

We hope this has proved interesting and useful to you just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for victory.

*You can get complete information  
about these tools from the Beryllium  
Corporation, Reading, Pennsylvania.*



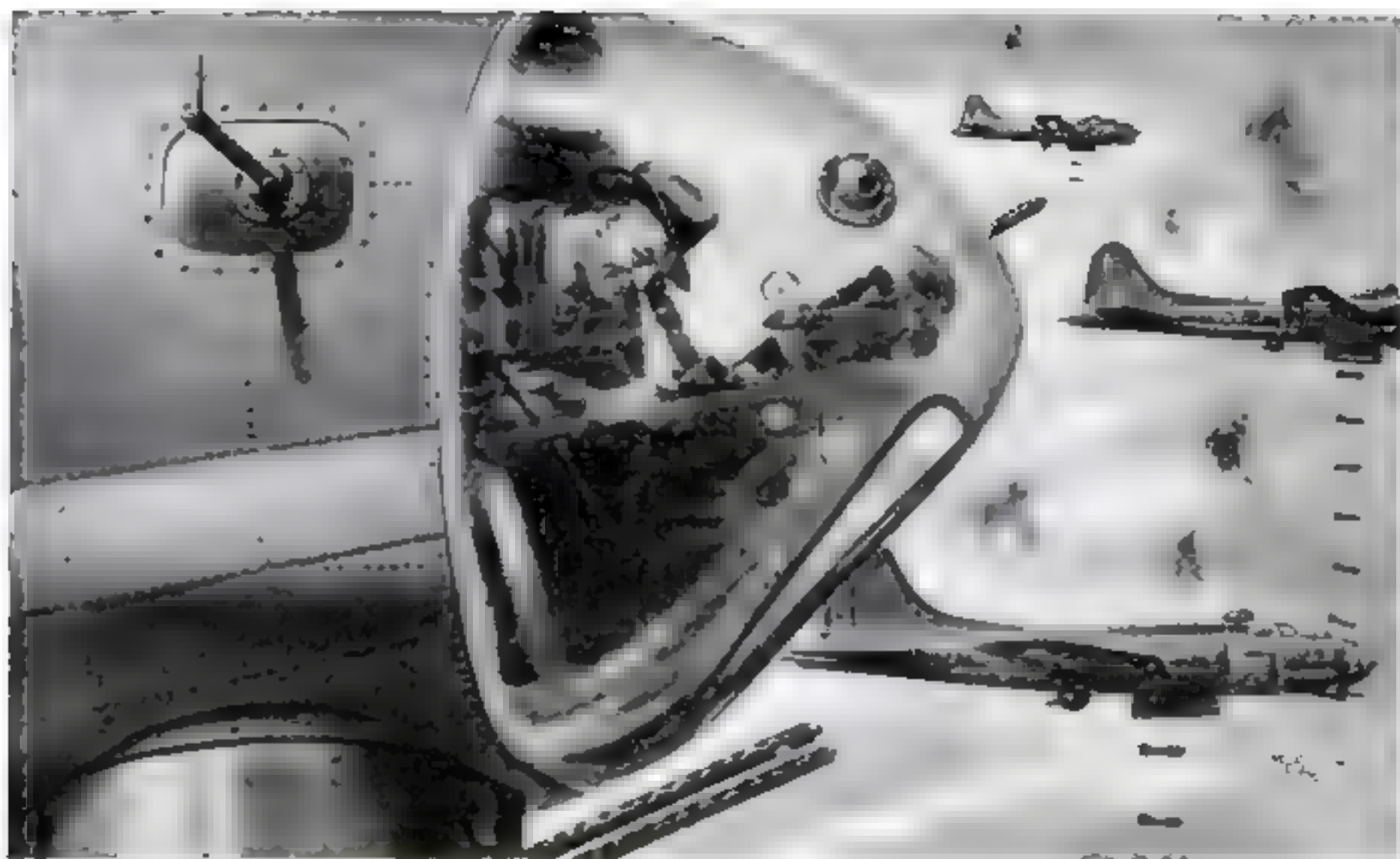
Man has tried for ages to rediscover the art of hardening copper. Today this can be done by adding to copper a small percentage of beryllium.



Not only does it produce an alloy harder than tempered steel, but one that does not produce sparks, an essential when working near highly combustible materials.

X-67





## THIS IS YOU IN A BOMBER!

Yes—there you are in the nose of a Fortress—about to release ten tons of “eggs” on a Jap ammunition dump in the Caroline Islands!

Of course, you can’t *really* be there in person. But you *are* represented there! The bonds you bought helped to build this Fortress . . . to pay for the bombs . . . to train the crew . . .

And just as these bomber crews go on hammering at Hirohito until their job is done . . . you will go on buying more bonds, saving scrap, giving blood, until final Victory is won.

Only then can we all enjoy the many startling improvements and innovations that will result from wartime research and experience.

Only then can American industry show

what it has learned these past few years.

For instance, if you’re a camera enthusiast, Universal will offer finer-than-ever cameras at prices well within your means. The experience gained in furnishing the Army, Navy, Marines and United Nations with precision optical equipment will open new horizons after Victory.

But in the meantime there’s only one way to make that Victory—those better times—possible. That’s by everyone of us backing every bomber . . . every tank . . . every sub . . . with everything we’ve got.

Make doubly sure of your place in that bomber—today!



There’s only one flag  
we’re prouder of!

# UNIVERSAL CAMERA CORPORATION

NEW YORK • CHICAGO • HOLLYWOOD

Makers of Precision Photographic and Optical Instruments • Peacetime Manufacturers of Cinemastar, Mercury, Corsair Cameras

FEBRUARY, 1944

Buy War Savings Bonds and Stamps regularly.

221



# Take the Br-r-r out of breakfast



## KEEP WARMER WITH BALSAM-WOOL ATTIC INSULATION



*A warmer house in the morning . . . more comfort all day long . . . that's what you get when you apply Balsam-Wool Insulation in your attic! And, while making your home more livable, Balsam-Wool actually saves fuel—as much as 20%, many householders find.*

Easy to apply—laid like a carpet in your attic, Balsam-Wool is the original blanket insulation—windproof, moistureproof and fire resistant. It is sold under a money-back guarantee of complete satisfaction. Don't wait—see your lumber dealer now. Ask him about his monthly payment plan—or mail coupon for complete information.

# Balsam-Wool

**SEALED ATTIC INSULATION**

Balsam-Wool . . . Products of Weyerhaeuser . . . No-Wood

WOOD CONVERSION COMPANY  
Dept. 211-2 First National Bank Bldg.  
St. Paul 1, Minnesota

Gentlemen: I want to know more about Balsam-Wool Double-Value Attic Insulation.

To assist us in giving you special information, please check: I am a home owner ☐  
renter ☐ architect ☐ contractor ☐  
student ☐

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_



## Flying Big Gun

*(Continued from page 108)*

Colonel (now Major General) G. M. Barnes. The gun was mounted in the fuselage of a junked B-18 bomber and fired on the ground to test the reaction of the fuselage to the shock of such an explosion. These early tests were successful, considering the crude equipment.

Encouraged but still cautious, the Ordnance men next obtained flyable models of the B-18 through the co-operation of the Air Forces, and went ahead with the most dangerous part of the experiment—flight-testing and firing the old cannon.

In every case, Captain Quinn himself insisted upon taking the risk of firing the first rounds from these makeshift mounts, and to his courage goes much credit for the final outcome of these dangerous experiments.

Five different mounts for the old 75 were tested, each more effective and lighter than the last. These were developed through the co-operation of the Watervliet and Rock Island arsenals.

With traditional Ordnance caution, enthusiasm was curbed during further modification until, in 1940, an improved model was demonstrated before the Air Corps Board at Eglin Field, Fla. As a result of this demonstration, and under the direction of Colonel Barnes as Chief of the Ordnance research program, a number of industrial companies were called in to help with development and manufacturing problems.

Their wholehearted co-operation produced a 75-mm. aircraft cannon more powerful than even the old French 75, with a perfected recoil mechanism and mount that met the peculiar requirements of aircraft installation. To Victor F. Lucht, an Ordnance Department engineer, goes credit for development of the recoil mechanism and the working out of the details that assured flawless performance of the assembled gun.

After more extensive ground tests, the new 75 was taken into the air under the supervision of Ordnance personnel. Again Captain Quinn came forward to take the risks attending the first firing aloft. The results justified these risks.

Now the problem was to find a suitable plane to take this great Ordnance achievement into combat. As this cannon was a fixed weapon, the ship to carry it had to have speed and maneuverability, with the guts to stand not only the installation weight but also the shock of firing. The size of the installation, too, had to be considered, along with the necessary equipment

*(Continued on page 228)*



# THE HOW AND WHY OF

## DATA ON WILLIAMS' TURNING TOOLS (Data Sheet No. 7)

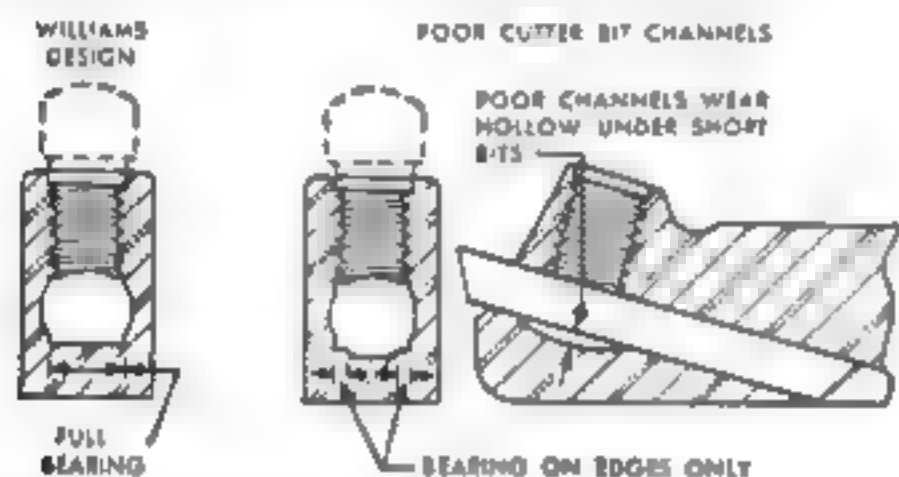
Tool Holders must be engineered to withstand the severe treatment which modern metal turning imposes on the cutting tool. Williams' Holders are drop-forged from a specially selected grade of steel, treated and hardened to develop maximum resistance to all wear and insure a hard rigid seat for the cutter directly under the holding or locking device. This tends to prevent cutter breakage which is due largely to the recess or pocket formed by short bits being forced into the cutter seat of the holder when the shank has not been properly hardened.



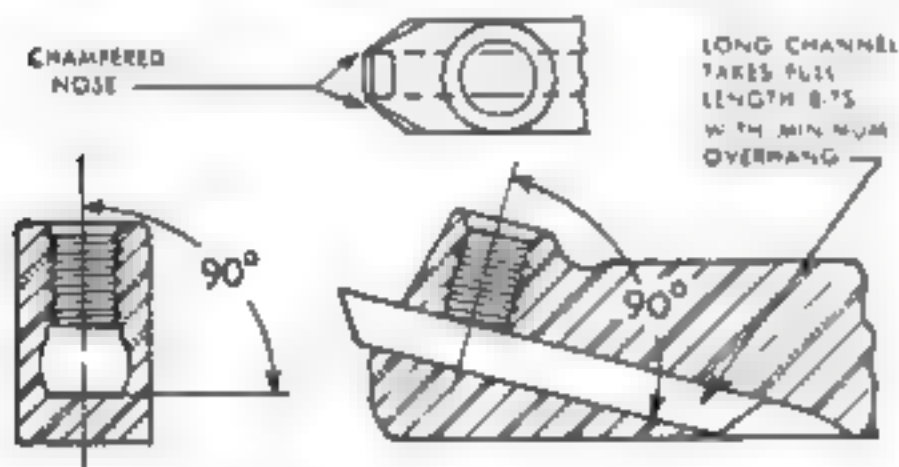
imum entry for the cutter bit. This feature assures minimum overhang when a full-length bit is used, thus reducing the danger of cutter bit breakage.

### Carbide Turning-Tool Holders

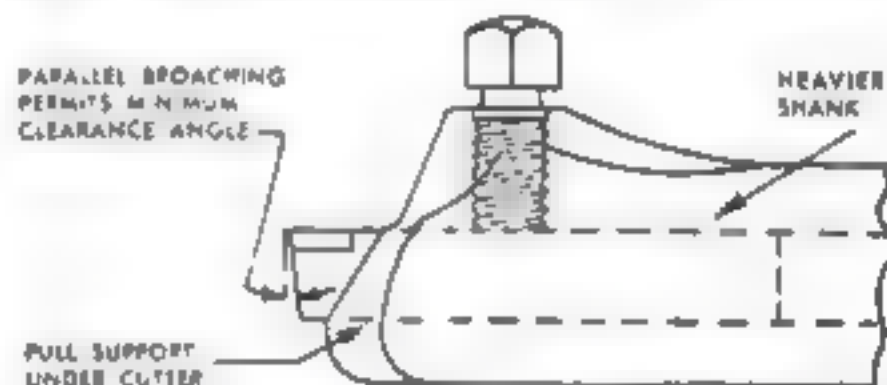
The brittle nature of tungsten carbide makes it absolutely essential that the bit be held rigid and the cutting edge supported as much as possible. To



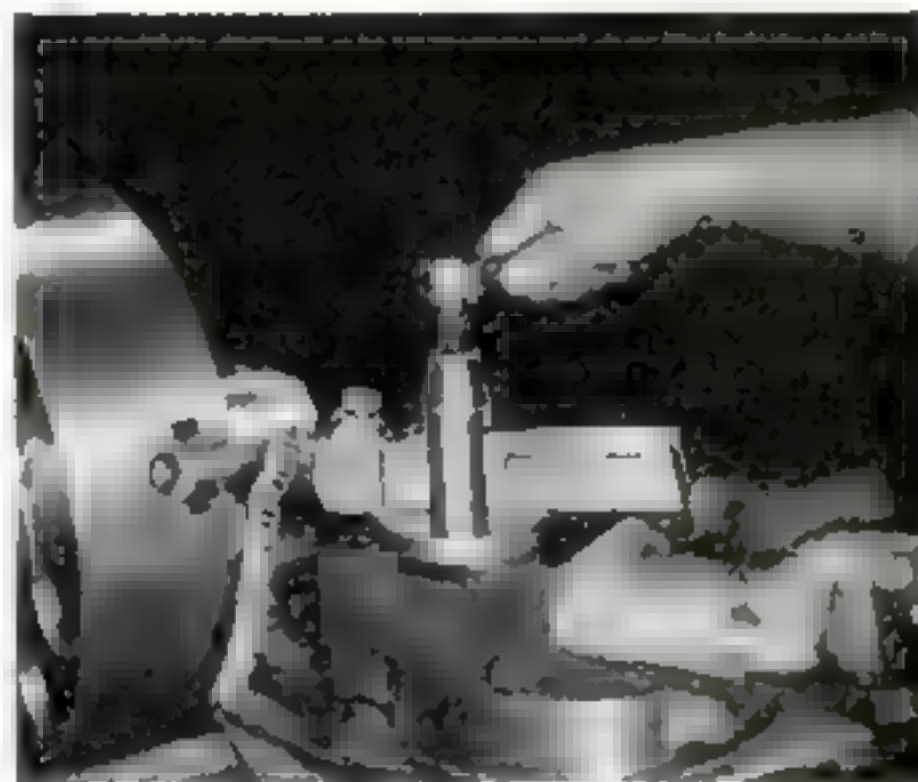
In Williams' Turning Tool Holders the nose is chamfered to permit convenient use in close quarters where space is limited. Set Screws are located at exact right angles to the cutter bit channel to provide full contact of the point of the screw with the cutter bit and insure maximum holding power. Screws



and tapped holes are held to the close fits essential for long life under gruelling tool holder service. Note that the extremely long cutter bit channel extends thru the bottom face of the shank, providing maxi-



accomplish this, the shanks of Williams' Carbide Holders are made heavier and longer than regular Holders of equal cutter capacity. The cutter channel is broached parallel with the base of the shank rather than at the usual 15° angle. The parallel broaching of the cutter slot permits proper grinding of the cutter so as to give maximum support to the cutting edge.



J. H. WILLIAMS & CO., BUFFALO 7, N. Y.  
ON USE OF SHOP AND HAND TOOLS

Your name and address in the margin below will bring 11 Tool Holder Data Sheets (punched for 3-ring binder) and a list of our complete Data Sheet series. Mail to above address, Dept. PS-2.

FREE DATA SHEETS



# There is no substitute for Experience

## ....in Roping or Outboard Motors



BACK THE ATTACK—BUY WAR BONDS

Looks easy—when a good man does it. But just try hitting the target without *experience*!

That's what we mean about outboard motors. Good engineering, good materials, good service—all these are necessary to the ultimate enjoyment of outboard motoring. And all of these improve with experience.

Take service, for instance. Our service department, which has been at its job for 20 years, plus a national organization of experienced dealers are prepared to give Johnson owners quick, effective service *where and when* they need it. (Excuse us, please, if our present service for the armed forces means slower service for you.)

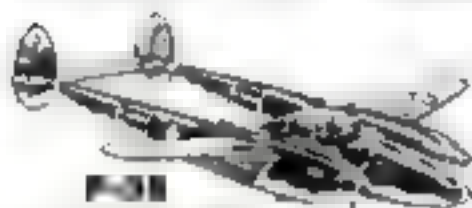


In service as in all other departments of outboard motor manufacture, there is no substitute for experience. That is a good point to remember—when outboard motors are again offered for sale.

JOHNSON MOTORS, Waukegan, Ill.

## JOHNSON SEA-HORSES FOR DEPENDABILITY

### When You Build CLEVELAND MODELS



**"LIGHTNING"**  
Deadly Interceptor Span  
38", C-D Master Kit \$4.00  
SF-36



**P-47 "THUNDERBOLT"**  
The "Flying Battleship" 40,000 ft. ceiling  
Span 30", C-D Master Kit SF-81 \$4.00



**36-in. Industrial Training Models**

Build these big 36-in. span models. Each a realistic beauty.

Kit T76 Messerschmitt Kit T78: Hawker "Hurricane"  
ME-109  
Kit T76: Bell "Albatross" Kit T85: Lockheed P-38  
cobra "Lightning"  
Kit T77: Curtiss P-40 Kit T81: P-51 "Mustang"  
"Warhawk" (shown) "Mustang"

Each complete Kit, only \$1.50

You're Building Models that Pilots, Bombardiers, Instructors, Cadets-in-Training and Mechanics of All Classes in the Air Force Build

Get your favorites, and get busy, now!



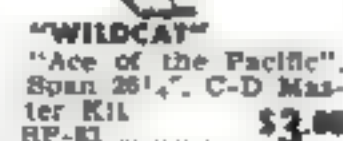
**"AIRACOBRA"**  
Span 25 1/2", C-D Master Kit SF-78... \$3.00



**"CORSAIR"**  
Navy fighter Span  
30 3/8", C-D Master Kit SF-79  
\$3.50



**Douglas SBD "DAUNTLESS"**  
World's hardest hitting dive bomber. Used by Navy and Marines. Span 30 3/8", C-D Master Kit SF-80... \$3.50



**"WILDCAT"**  
"Ace of the Pacific". Span 26 1/4", C-D Master Kit SF-83... \$3.00

**Lockheed "HUDSON"**  
Bomber

Used for bombing, fighting reconnaissance. Called "Old Boomerang" by British, for it usually comes back. Big 49 1/2" span C-D Master Kit SF-85... \$7.50



**"MUSTANG"**  
(P-51Z)  
Tough, vicious fighter, 350 mph. Span 27 3/8", C-D Master Kit SF-91... \$3.00

### Huge 7-Ft. Super CONDOR Glider Soars for Hours

Stronger, longer flights, more graceful lines, construction simplified. Easier than ever to build. Kit E-5019, only \$7.00



See your dealer first. If he can't supply you, order direct. Include 15c post-pack charge with ALL orders.

Send 5c for new No. 41 Catalog (none free)

Cleveland Model & Supply Co. ★ "World's Largest Mfr. of Quality Model Aircraft Since 1919" ★ 4508D16 Lorain Ave., Cleveland 2, Ohio



# You owe it to your Uncle Sam!

*He needs manpower—every available person. A hearing deficiency may keep you out of the armed forces. . . but you can do your fighting on the home front . . . in war materiel plants. A good hearing and enables you to go all out in the war effort. The movement is growing. In our plant today are workers wearing hearing aids and contributing as competently as if their hearing were normal.*

## You owe it to your friends!

They want to enjoy your company as much as you do theirs. Your hearing aid means as much to them as it does to you.

## Are you really doing your part?

That question only you can answer. *Think!*

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

## Report on a Revolution

Zenith recently started a revolution—to reduce the *cost of hearing*. After years of research and preparation, the Zenith Radionic Hearing Aid is now offered to the public.

The price—\$40—(about one-quarter that of other good vacuum tube instruments). Complete—ready to wear—with miniature radio tubes, crystal microphone and batteries—liberally guaranteed.

Inquiries from everywhere have flooded the mails—telephone calls—telegrams.

A sales volume—unheard-of in this field—is gaining daily momentum—and is a demand created by

self-evident merit of the instrument itself. Today our problem becomes one of production and distribution—to as quickly as possible make the Zenith Radionic Hearing Aid available in all localities.

We are doing our best to furnish additional manpower for Uncle Sam's production forces. And—in the doing—we are experiencing that rare satisfaction born of directly contributing to the welfare of individuals.

THE ZENITH HEARING AID WILL BE AVAILABLE THROUGH REPUTABLE OPTICAL ESTABLISHMENTS FRANCHISED BY ZENITH (NO HOME CALLS OR SOLICITATIONS) Write us for address of outlet nearest to you.

☆ ☆ ☆ ☆

There are cases in which deficient hearing is caused by a progressive disease and any hearing aid may do harm by giving a false sense of security. Therefore, we recommend that you consult your otologist or ear doctor to make sure that your hearing deficiency is the type that can be benefited by the use of a hearing aid.

### TO PHYSICIANS

A detailed scientific description will be sent upon request. Further technical details will appear in medical journals.

## The New Zenith RADIONIC HEARING AID

**\$40<sup>00</sup>** READY TO WEAR

Complete—with Radionic Tubes—Crystal Microphone and Batteries . . . *Liberal Guarantee*

Zenith has built the best that modern knowledge and *radionic* engineering make possible into this \$40.00 hearing aid. It has no other models . . . *one model . . . one price . . . one quality.*

*Write for Free Descriptive Booklet*

ADDRESS DEPT PS-2, HEARING AID DIVISION

**ZENITH RADIO CORPORATION**  
CHICAGO 39, ILLINOIS





# Wanted

## POSTWAR PRODUCTS

★ Have you a good idea for a post-war product—a patent—a fully-developed commodity with national volume sales possibilities that can be produced in whole or part from metal stampings? Write us about it now—in confidence.

★ More than a quarter century's experience in the fabrication and assembly of metals of all descriptions, plus expanded facilities and skilled manpower, will enable us to manufacture and merchandise soundly-designed, new products for peacetime demands.

★ We will acquire the items selected by our Postwar Products Committee either by purchase, royalty or contract.

★ If you know of a product that you believe we can manufacture to advantage, please send complete information by letter, accompanied by blueprints, drawings or sketches.

★ Your suggestions will be held in strict confidence and fully protected here. We will review them with care and interest, and arrange for a personal interview if we wish to consider them in detail.

Please address:

Postwar Products Committee

THE GEOMETRIC STAMPING COMPANY  
1115 East 200th Street • Cleveland 17, Ohio

# GEOMETRIC

## Sound: Wartime Tonic

(Continued from page 128)

Findings of Dr. Harold Burris-Meyer and his chief assistant, R. L. Cardinell, have aided hundreds of plants.

Too much music in industry is like too much ice cream—sickening. Cardinell's tests show that when music is played continuously workers fail to react at all. All kinds of timing have been tried. Music for one, two, three hours. Music for ten minutes—off ten—on ten. Music for intermittent 30-minute periods. Music for one hour at start of work and before closing.

This is the best advice to date:

Two hours of music is sufficient for any eight-hour work period.

Avoid identifiable vocalists or tricky instrumental music. "Deep in the Heart of Texas," for instance, is out. It stops work because, naturally enough, workers feel obliged to clap the chorus.

In general, use familiar music—dance tunes, Viennese waltzes, and the like.

Provide bright, snappy music at start of work and just before daily fatigue points.

Don't play music louder than is necessary for good definition. It should be background, not spotlighted effect.

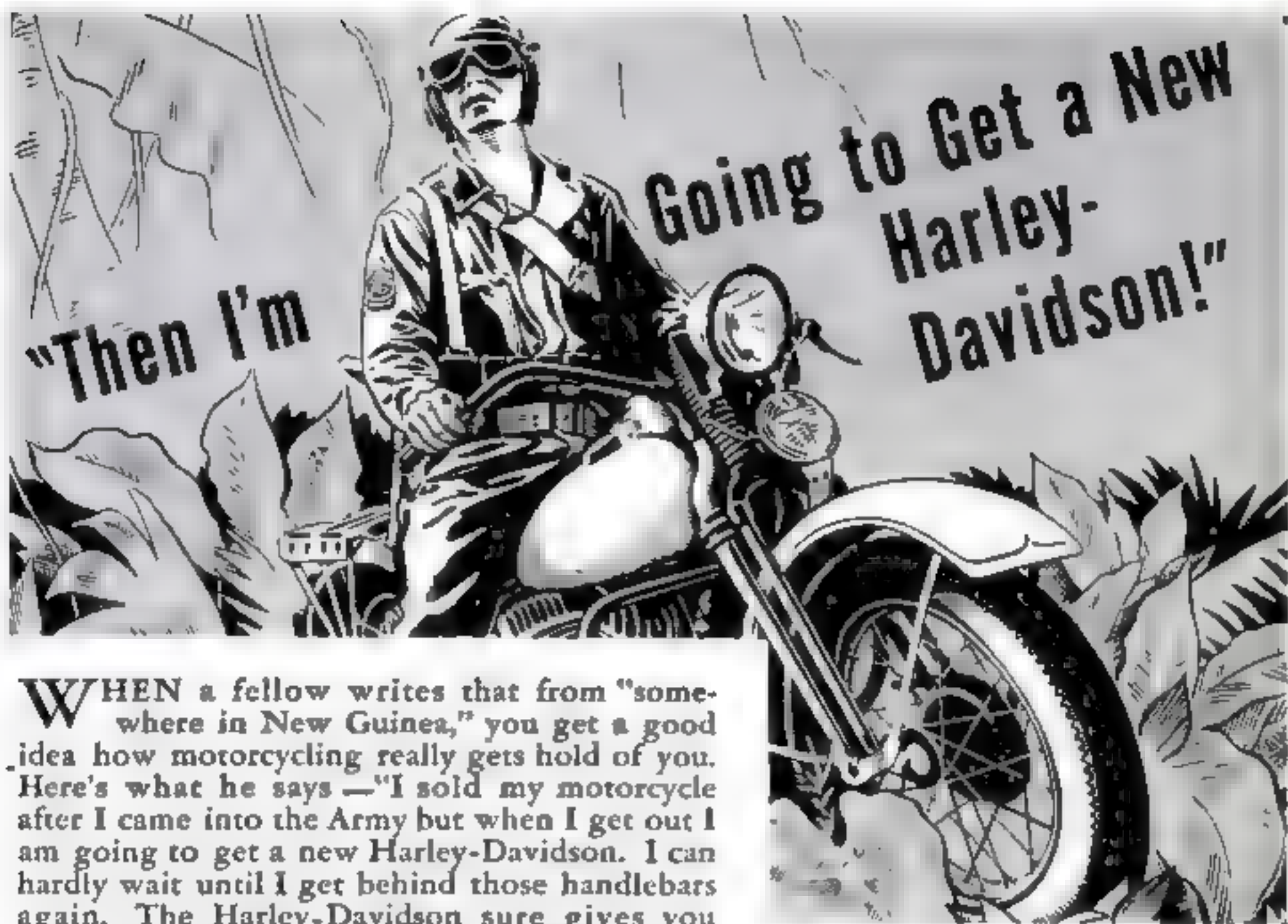
Select music so as to create a progressive mood, building up intensity and tempo from operetta to waltz to foxtrot. This gives the worker a gentle push, and has a carry-over for an hour or more.

Requests of workers should consume luncheon programs, and may include numbers regarded as too "hot" to work by

### ANSWERS TO QUIZ, PAGE 127

(1) "Hike Notre Dame"; College marches are preferable to military music, as the latter tends to depress workers by calling to mind loved ones in the service. (2) "You Are My Sunshine"; religious music often stops work like a fire gong. (3) "Merry Widow" Waltz; polkas are too fast and too noisy for good work on assembly lines. (4) "William Tell" Overture; war songs tend to depress employees, especially women. (5) "Auld Lang Syne"; so-called "high-brow" music is incongruous in a war plant. (6) "Sweet Leilani"; raucous vocals are taboo. (7) "Ahi Sweet Mystery of Life"; playing the national anthem often stops work by causing workers to stand at attention. (8) "One Alone"; there is too much action in "Irish Washerwoman." (9) "Home on the Range"; ragtime and fast swing music upset workers' production rhythm. (10) "Why Do I Love You?"; noisy South American numbers are disturbing to most war workers.





**W**HEN a fellow writes that from "somewhere in New Guinea," you get a good idea how motorcycling really gets hold of you. Here's what he says — "I sold my motorcycle after I came into the Army but when I get out I am going to get a new Harley-Davidson. I can hardly wait until I get behind those handlebars again. The Harley-Davidson sure gives you economical transportation. So until this is over and I am back in the saddle, keep them rolling."

You bet, Dave — we're keeping 'em rolling to the armed forces so you'll be back home sooner. And in the race meets, gypsy tours, hillclimbs and endurance runs to come, war-proved Harley-Davidsons will be out in front! Lots of fellows are buying War Bonds now — to get new Harley-Davidsons after Victory!

## HARLEY-DAVIDSON MOTORCYCLES

**HARLEY-DAVIDSON MOTOR CO.**  
Department P-5, Milwaukee 1, Wisconsin

Please send at once free copy of 24-page  
"Enthusiast" Magazine, filled with motor-  
cycle action pictures and thrilling stories.

Name

Address

City  State

SEND COUPON  
**NOW**





## Practice for an R.C.A.F. Pilot

"I am a New Zealander, serving with the Royal Canadian Air Force. I have hunted throughout New Zealand and hold the record for the biggest wild boar shot to date. This beast fell to my .22 Marlin rifle, from 40 yards. This rifle is looked upon as the most accurate and long-lived rifle now in the hunting circle."

S-H-N.Z. 416819 R.C.A.F.

Thank you, pilot. The sport you enjoyed and which, God willing, you will follow again, has prepared you well for still bigger game across the seas. Marlin wishes you good hunting!

THE **Marlin** EST. 1870 FIREARMS CO.  
New Haven, Conn.

★ Turn in your old shells and cartridges to local scrap collection. Metal urgently needed for war production.

**ACCURACY...** Marlin rifle barrels—of all models; lever action, clip and tubular magazine—have deep-cut "Ballard" rifling. Their exceptional accuracy has been a byword for generations.

**SAFETY...** Rugged solid top receivers and safe side ejection are famous safety features of lever-action Marlin Rifles. The solid top construction is also ideal for low telescope mounting.

**DEPENDABILITY...** Marlin Gun actions are noted for simplicity, for positive, reliable performance in the field. Marlin's model 39A is the only take-down rifle exposing all working parts by the turning of a single hand screw.

## Flying Big Gun

(Continued from page 222)

and accessories and a man to load the gun.

Several manufacturers were consulted. It was a lucky break when North American Aviation came forward to offer the Mitchell B-25 bomber as the steed. Already it had been battle-proved on every front. If it would do, months would be saved in getting the gun into combat.

By a happy design coincidence the Mitchell was ideal. Along the left side of the fuselage, under the pilot's compartment, it had a tunnel used by the bombardier in getting into his nose position. This might be just the spot for the placing of the gun.

To North American, then, was given the exacting problem of installing the 75 in a combat aircraft for the first time. Company experts received the drawings of the gun and installation in mid-August 1942, and George Bussiere, staff engineer in charge of ordnance, gathered his able assistants about him and dug in for a session of sweat and toil.

What they really had to work with were the M-4 aircraft cannon and the M-6 aircraft-type mount as developed by the U. S. Army Ordnance Department. What they had to achieve was the attaching of these units to the Mitchell medium bomber.

First the group studied the Mitchell's structure to see if it would do "as is." It would—on paper—for months before added ruggedness had been built in to support the nose wheel. Tests were made, and the consensus was that she could "take it."

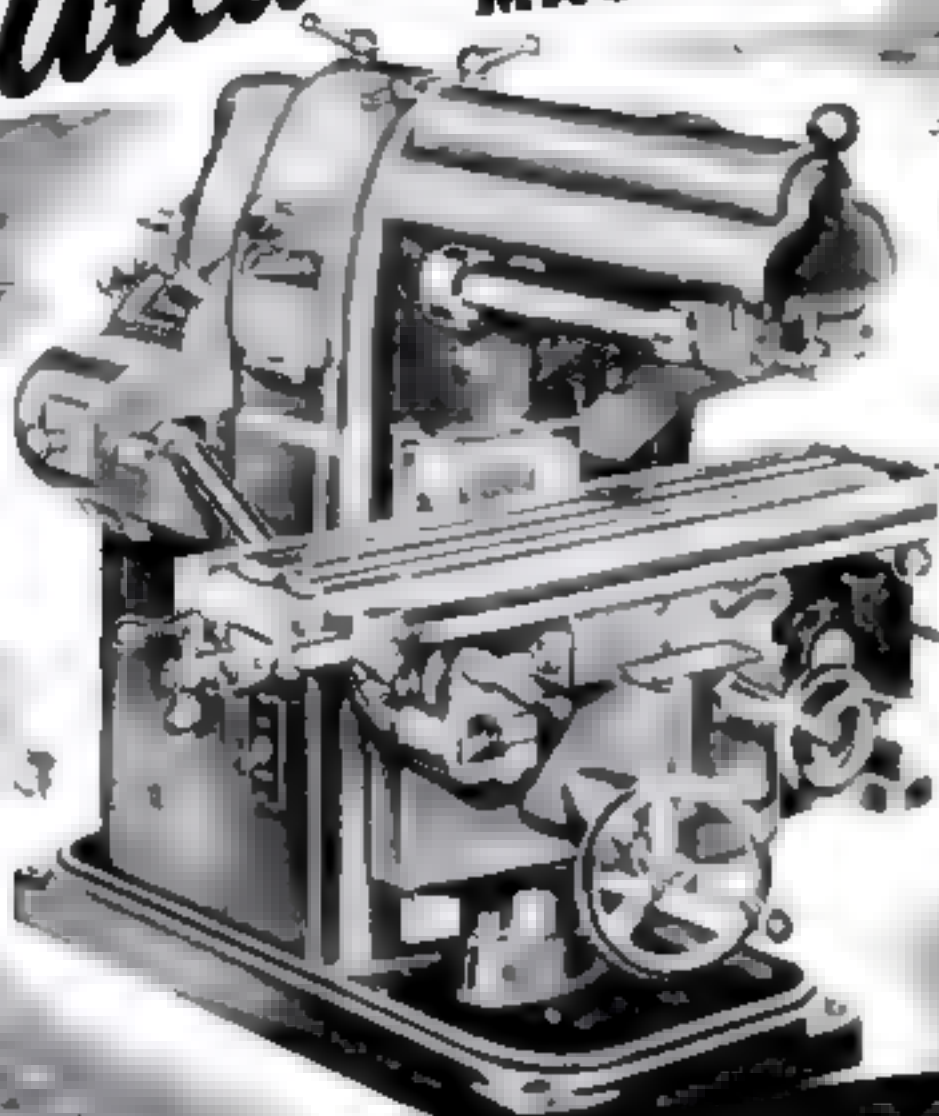
To accommodate the gun muzzle, a mild-steel port was fitted to the nose of the ship at the end of the bombardier's tunnel. The nose itself was entirely enclosed in metal, replacing the transparent sections in the standard model. Above the cannon muzzle, mountings for two .50 caliber machine guns were fitted as auxiliary weapons, and the necessary armor was added for safety.

During the next four months, test sections of the altered fuselage were taken under wraps to isolated sections of the California coast for testing on a 200-yard range. Here, in utmost secrecy, test firings were made with loads ranging from half charges to more than 115 percent of normal combat charges. As the thunder of these explosions died away, the sections were started back for a final check at the factory, where the verdict was pronounced with satisfied grins: "She can take it—and plenty more!"

Just three months from the day when Bussiere first opened the blueprints, test-pilot Rudd was firing the 75 over the Pacific.



# Atlas MILLING MACHINE



**CONDENSED SPECIFICATIONS**  
 Table  $4\frac{1}{2}" \times 16"$  Number of Spindle Speeds 12  
 Table Travel  $8"$  Speed Range 61 to 2640 RPM  
 Longitudinal  $8"$  Overall  $20\frac{1}{2}" \times 20\frac{1}{2}" \times 22"$   
 Vertical  $8"$  Motor  $\frac{1}{2}$  HP 1740 RPM

## Precision PAVES THE WAY TO TOKYO!

Sharper shooting . . . closer bombing . . . greater speed—that's our edge on the Nips! And the precision that makes it possible begins on American production lines where less than a thousandth of an inch is a sacred thing to Uncle Sam's crack machinists.

In production plants throughout the country and in the mobile machine shops of our armed forces, Atlas machine tools are helping make and keep our fighting weapons on top. The Bench Milling Machine is one of the Atlas tool room and production favorites that have taken over small parts work to release large machines for larger jobs in plant after plant. This compact, modern tool handles all milling operations with split-hair precision.

Keep these facts in mind when you think about equipment for your post-war shop. Atlas Tools are proving their worth throughout the world.

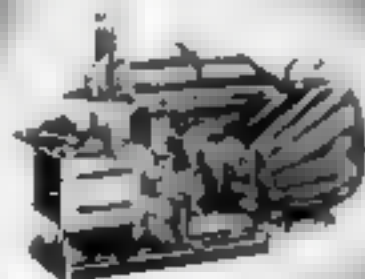


# ATLAS PRESS COMPANY

255 NORTH PITCHER STREET • KALAMAZOO 130, MICHIGAN



LATHES



SHAPERS



DRILL PRESSES

★ BUY WAR BONDS NOW ★

FOR A NEW *Atlas* SHOP AFTER THE WAR









## "Pin-ups"... we all have them!

Lovely Pin-up girls a-plenty... but barrack walls can't hold all the pictures a soldier sees. Beyond are other scenes... perhaps of that winding inlet, blue and silent... the big grey rocks topped with pines against the sky... the bass that smashed and fought like fury... "Man, oh man... when I get back!"

In fox-hole or gun turret... or at bench, machine or desk... we all have our "pin-ups". Things we've enjoyed before and that we're going to enjoy again. Mental pictures that to each of us satisfyingly symbolizes the freedom that America is fighting and working for.

The fine motors that now go, and which for more than two years have been flowing from the Evinrude plant to all branches of our fighting forces, are designed to speed the day of Victory... when *pin-ups* can become *realities*.

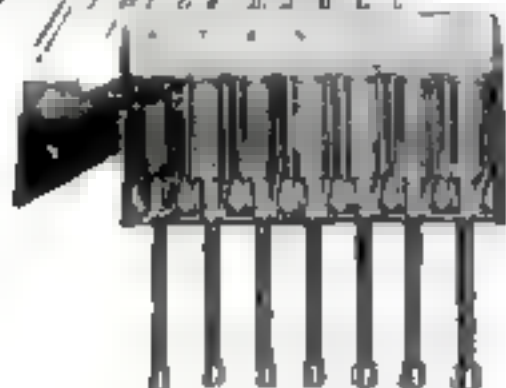
**EVINRUDE MOTORS, Milwaukee, Wisconsin**  
Evinrude Motors of Canada, Peterboro, Canada

# EVINRUDE

OUTBOARD MOTORS



## FASTER NUT DRIVING



SEVEN SIZES  
SEVEN DIFFERENT  
COLORS—HANDLES  
COMPLETE IN  
LOCKABLE METAL  
TOOL HOLDER

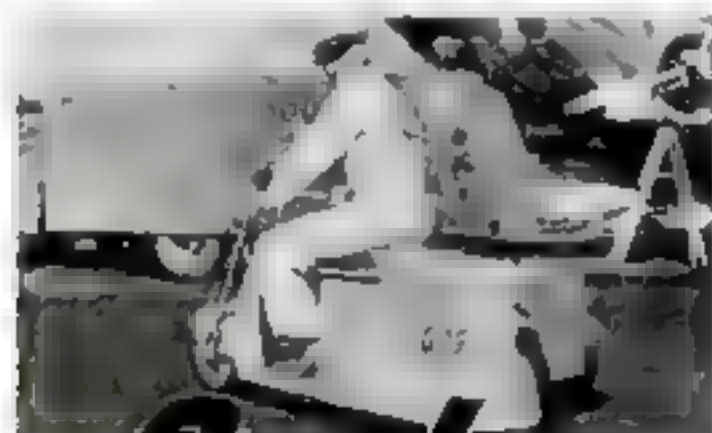
You can well be proud of this set of tools—and their efficient performance, on all kinds of electrical work! Each size of nut driver has a handle of a different color. No fussing around for the correct size—just select the color. Handles of special plastic are resistant to electrical shock and fire. Sockets are precision formed, deep enough to handle two nuts. Sizes range (in 32nds) for nuts from 3/16" to 5/8". Supplied in sturdy metal holder which can be wall mounted and locked. Ask your radio, electrical or hardware dealer or write: Dept. 1.

**PARK METALWARE CO., INC.**

Orchard Park, New York

**XCELITE**

QUALITY TOOLS  
PREPARED BY THE EXPERTS



# Cushman

America's speed in equipping herself for war has amazed the world! One reason is that whole fleets of powerful little CUSHMAN Motor Scooters zip through many great wartime plants, saving time and manpower.

Where several foot messengers formerly delivered mail, orders, messages—one CUSHMAN now does the job! Where precious time was lost as inspectors, officers and others walked long distances, CUSHMANS now get them there in a hurry! It's convenient! It's economical! It's easy to stop and park anywhere!

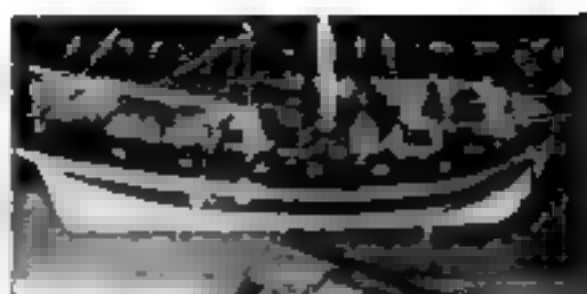
**WAR NEEDS TAKE MANY CUSHMANS:** The CUSHMAN has so thoroughly proved itself under terrific wartime pressure, that the Army, Navy and Air Forces—at home and at the front—are buying them in large numbers. With the Army-Navy "E" at our masthead, we are turning them out faster than ever!

**SEE YOUR DEALER:** See your dealer who handles the CUSHMAN. Or, send for free booklet, with photos, full details and Low Prices.

Help bring war's end nearer—**BUY WAR BONDS!**

**CUSHMAN MOTOR WORKS, Dept. M-6, Lincoln, Nebr.**

## SHIP MODELS ILLUSTRATED with a guide to modeling



\$2  
POSTPAID

Is the best book of its kind ever published — of ship models, of real ships, of masts, of rigging, of furniture, of deck gear — covering many types of vessels from whaleboats to PT's from "blazers" to Corvettes. It incorporates many color plates, closeup photos, detailed drawings and actual construction plans. In addition to a fully text covering ship model building and a glossary of nautical terms. Send for it today. We'll include our catalogue of ship model kits and supplies.

**MARINE MODEL CO. DEPT. P-4 NEW YORK CITY**

## POST-WAR PRODUCTS WANTED

We are interested in new products whose principal parts might be forged, cast or pressed from steel, aluminum or magnesium. Will consider developed or partly developed ideas. Correspondence invited with inventors, designers, engineers and patent attorneys which will be treated in strictest confidence. Established over 60 years, we have capable engineering and experimental staffs. Prompt attention. Write

**RESEARCH DEPT., J. H. WILLIAMS & CO., BUFFALO (7), N. Y.**

Com-  
plete \$20



## ENGINES IN STOCK

The G. H. Q. miniature gasoline engine that really operates is still available. Over 15,000 sold in the last year. 1/8 H.P. Complete with flywheel and propeller, fuel, 13 accessories and full instructions. Fully bench tested and ready to run. For boats, planes, model cars, etc. Send only \$1.00—Shipped Collect C.O.D. same day. Send 35c for Illustrated Catalog of hundreds of hobby items.

**GHQ MOTORS, Dept. 5V, 40 East 21 St., New York 10, N. Y.**



## WINN'S NEW IDEA HOME LABORATORY CHEMICAL KITS

For High School & College Students. Send 5c for Literature and Retail Supply Catalog. **J. H. WINN MFG. CO., Dept. 102 124 W. 23 St., New York 11, N. Y.**



## SELL ELECTRIC FENCE

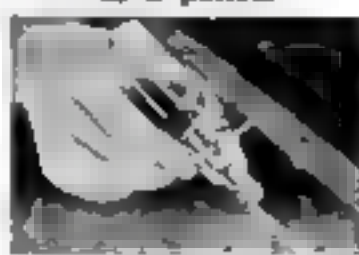
The New HIBALL FENCE KIT is the best yet. Sell dealers or direct. Salesmen make up to \$150.00 per gross. Good territory open. 3 Samples, \$3.00.

**LEJAY MFG. CO. 2023 Lejay Bldg., Minneapolis, Minn.**

## PAINT STRIPING TOOL / ONLY \$1.00 POST PAID

Try it! See the Added Beauty

With this NEW TOOL (not a brush) everyone can now draw lines with paint. Used on signs, models, toys, tiled walls, cabinets, furniture, linoleum floors and all home workshop projects. Send only \$1.00 for complete tool for painting a 1/16" wide stripe, including adjustable guide, operating instructions, etc. Tool uses paint enamel lacquer, etc. Patented interchangeable tips are available for wider or narrower stripes.



Every Painter and Craftsman Should Own One. Send for your tool today. Use it. If you are not satisfied that you have added character as well as beauty to your work, return the tool and we'll refund your money promptly. Dealers. Write for literature etc.

**WENDELL MFG. CO. 2543 N. Ashland Ave., Chicago, Ill.**



**Delta**  
CRAFTSHEETS



Here's a handy collection of technical dope that  
makes it easy to do finer work, faster, in your  
**Homecraft Shop**

Handsome  
leatherette  
binder

A  
few sheets  
from  
Batch No. 1

Practical material, arranged for quick reference,  
helps you master more tools and operations . . .

Homesteaders all over the country  
have given a rousing welcome to  
Batch No. 1 of Delta Craftsheets!  
These 30 fact-filled sheets from the  
world's leading maker of home  
power tools, add to your skill, help  
prevent waste of time and material.

Sheets are reprinted from The Delta-  
gram, the magazine for home crafts-  
men. On heavy paper, with the back  
blank for notes, they are easily re-  
moved from the handsome ring bind-  
er for use at the bench.

**At Your Fingertips!**

Here is hard-to-find material that  
usually appears only in expensive  
books, arranged for quick, easy ac-  
cess, helping you turn out work that  
marks you as an expert.

**For examples:**

In Batch No. 1 you find a sheet show-  
ing how to compute pulley speeds,  
complete with examples and diagrams.

Another sheet shows how to cut  
nutted segments for figures having  
from 3 to 14 sides.

There are sheets on Shaper Knives,  
Spark Test for Metals, Taper Turn-  
ing — Setover Method, Application  
of 3-Knife Cutter Head, Abrasive  
Disks (with table for selecting and

instructions on fitting), Standard  
Wood Mouldings, the Lathe Index-  
ing Head, Types of Hinges (2 sheets),  
Layout Problems, and many others.

**Tables and Charts**

Included in this Batch of Craftsheets  
are valuable tables and charts, such  
as: Speeds and Lubricants for High  
Speed Taps and Drills; Basic Thread  
Dimensions and Tap Drill Sizes;  
Common Wire Nails — size, length,  
gauge, etc.; Tables of Cutting Speeds;  
Counterbore Size for Cap Screws and  
Machine Screws, etc.

**Add to your Library**

These Craftsheets make an important ad-  
dition to your home workshop library,  
one that grows even more valuable  
as additional batches are issued.

You may order the binder or the  
sheets separately. But for permanent  
neatness and convenience, we suggest  
that you order both.

Fill out the  
coupon and  
mail it today  
with check,  
money-order,  
or stamps.  
Send promp-  
tly to be sure  
of early de-  
livery.

Batch No. 1:  
of Delta  
Craftsheets 25¢  
Ring Binder 50¢  
Total — 75¢

Tear out and mail coupon today

Editor, Deltracraft Publications  
THE DELTA MANUFACTURING CO.  
683B E. Vienna Avenue, Milwaukee 1, Wisconsin

1488

- I am enclosing..... for
- ☐ Batch No. 1 of Delta Craftsheets only..... 25¢
  - ☐ Ring Binder for Delta Craftsheets..... 50¢
  - ☐ BOTH Batch No. 1 and Ring Binder..... 75¢

Name.....

Address.....

City..... (.....) State .....

**DELTA**  
**MILWAUKEE**  
*Power Tools*



SYN-FLO...

# LIQUID-PLASTIC ENAMEL

- ★ Finishes walls like TILE
- ★ Finishes woodwork like PORCELAIN

This is really it! Modern science has produced this new white PLASTIC coating you apply with a brush. It actually has the same chemical properties of genuine molded plastic products.

## A BRUSH-ON PLASTIC

With an ordinary brush you flow this coating on your woodwork and it dries to a smooth porcelain finish—hard, water-proof, abrasion-resistant—stays brilliant white.

You won't have to wait until after the war for this new, scientific, plastic discovery. Limited quantities now available.

## MONEY-BACK GUARANTEE

One gallon SYN-FLO Liquid Plastic will cover walls of average room. Send only \$5.95 for full Gallon SYN-FLO with Special Thinner, express prepaid Will ship C.O.D. if desired.

LIMITED SUPPLY AVAILABLE TO PUBLIC NOW ORDER AT ONCE! FREE ILLUSTRATED CIRCULAR ON REQUEST.

SUPERIOR PAINT and VARNISH WORKS  
8355-2274 N. Elston Ave., Chicago 18

# Mortite UTILITY TAPE

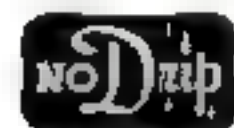
## BETWEEN YOU AND THE COLD

New pliable plastic stops leaks, saves fuel. Weatherstrips windows, doors, baseboards — caulks casements; makes packing, gaskets.

## EASY TO APPLY

Unrolls like ribbon. Just press into place and it stays put. Does not crack, chip, dry out or shrink.

About 80 ft. to a roll. At stores or \$1.25 prepaid (\$1.40 west of Rockies).



**STOPS THAT DRIP**—A sure cure for condensation drip from tanks, pipes, walls, ceilings, etc. Apply with brush, trowel or spray. At stores or \$1.90 for 1 gal. prepaid. (\$2.10 west of Rockies.)

Circular on Mortite or NoDrip on request

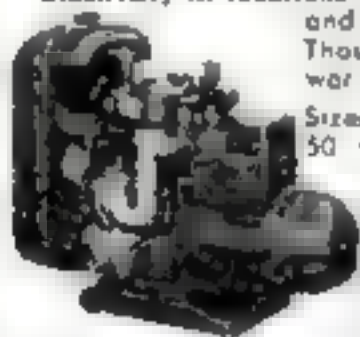
J. W. MORTELL CO. 534 Birch St. KANKAKEE, ILL.



**ONAN**  
ELECTRIC PLANTS

## Electricity for Any Job—Anywhere

ONAN GASOLINE DRIVEN ELECTRIC PLANTS provide electricity in locations where it is not otherwise available, and for emergency and standby service. Thousands doing a winning job in the war.



Sizes from 350 to 35,000 watts. A.C. 50 to 800 cycles, 110 to 660 volts. D.C. 6 to 4000 volts. Also dual A.C. and D.C. output models. Details gladly furnished.

**D. W. ONAN & SONS**

1813 Royallston Ave.

Minneapolis, Minn.

## BATTLE TESTED

## For YOUR Car

• Wartime research, engineering and actual use in battle areas assure you an improved HULL AUTO COMPASS for post-war driving. Remember the name—HULL. HULL MFG. CO., P. O. Box 246-E2 Warren, Ohio



BUY BONDS  
Assure  
Democracy's Future

Build a **STURDY WORK BENCH** from complete working plan in Stanley Set No. 11. Includes 4 other good plans. Now 14 sets to choose from. **EACH SET OF PLANS ONLY 10¢**

**STANLEY TOOLS,**

Division of The Stanley Works  
212 Elm St.  
NEW BRITAIN, CONN.

# Try Anti-Gray Hair Vitamins

## Plus Wheat Germ Oil (E) Vitamins ON THIS MONEY BACK OFFER

### RESTORING COLOR TO GRAY HAIR WITHOUT DYES IS SCIENCE'S LATEST MIRACLE

If your hair is gray, graying streaked, faded or off-color, modern science offers new hope without dyeing. A lack of certain vitamins in your daily diet can cause hair to turn gray. Improve your diet, get extra supplies of these "Anti Gray Hair" vitamins by simply taking the original 2-way Panates Vitamin treatment. You can may be amazed and delighted to see the gray spread stopped, restoration of normal natural color to the hair at roots, temples, parting, a great improvement in your hair beauty. You can now test Panates yourself on an iron clad guarantee that leaves no room for doubt.

PANATES is different—it not only contains a powerful supply of "Anti Gray Hair" Vitamins but "Staff-of-life" Vitamin (E) Wheat Germ Oil as well. Panates is not a hair dye. You have nothing to fear. No mess, no fuss. You can test safe, healthy Panates whether you now dye your hair or not because Panates Vitamins work from within to check gray spread and literally feed natural color back into the hair roots.

When the blood does not provide the proper elements, the tiny laboratory that manufactures color shuts down and the hair grows gray. Perhaps you may need the vitamins in Panates. Make this test today.

### SEND FOR THIS INTRODUCTORY TRIAL OFFER TODAY



The 20 day trial of the regular \$4.75 (90 day) Panates double action vitamins is only \$1.75 if you act at once! **SEND NO MONEY** pay postman plus C.O.D. postage on arrival on guarantee of full satisfaction or money back. Send \$1.75 and we pay all postage. Or, if you want more of the amazing Panates Anti Gray Hair Vitamin story, write for **FREE Valuable Booklet**, "Vitamins and Gray Hair." No cost, no obligation. Whatever you send for, get your letter or postcard in the mail today while Special Offer is available. Who knows perhaps the 2 vitamins in Panates may be the wonderful easy-way answer to your hair color worries!

**PANATES CO.**

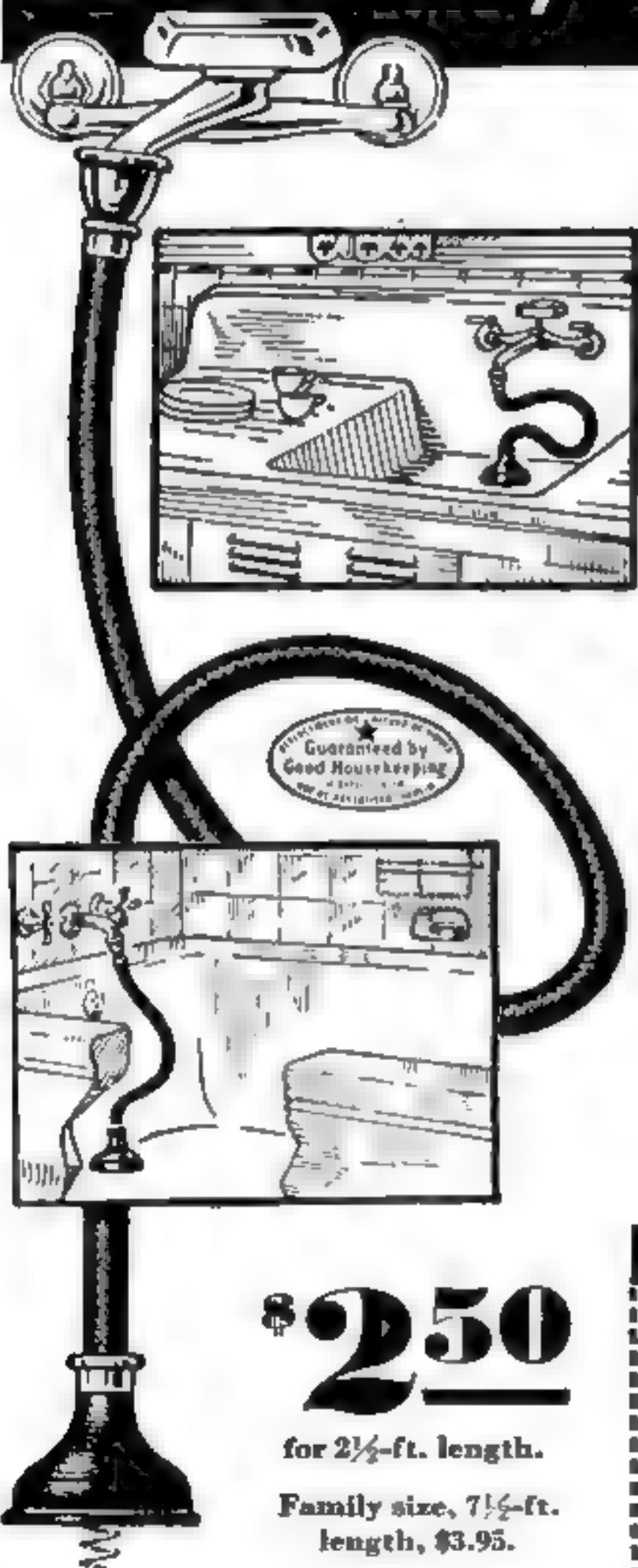
Not in Stores, Write  
Dept. B-262, 310 S. MICHIGAN  
AVENUE, CHICAGO 4, ILLINOIS

POPULAR SCIENCE



# AT LAST!

*Now You Can* **BLAST OUT CLOGGED, DIRTY DRAINS**



**Clean Them Thoroughly With  
CARTER**

## WATER PRESSURE DRAIN CLEANER

So Easy to Use. The minute you notice a slow-running drain put a Carter Water Pressure Drain Cleaner to work. Cleans out filth, corrosion, soap curds and other stoppages in double-quick time!

Uses water pressure to clean drains, and operates on an entirely different principle from anything you have ever seen. Simply attach and it works automatically. Has no moving parts. Uses no caustics or other dangerous chemicals. Good for many years of service.

Get Yours TODAY—Designed for use on lavatories, toilets, kitchen sinks, laundry tubs, bathtubs and basement drains. Housewives are delighted with the wonderful job it does. Indeed, any woman can use it. Get yours today. Ask your neighborhood dealer or you may order direct by using the coupon.

ONTHANK-DAVIS CO., Dept. PS, Des Moines 9, Ia.

**CARTER**  
WATER PRESSURE DRAIN CLEANER

## MAIL COUPON TODAY!

Onthank-Davis Co., Dept. PS, Des Moines 9, Iowa

- ☐ I enclose \$2.50. Send me Carter Drain Cleaner with 2½ ft. length.  
☐ I enclose \$3.95. Send me Carter Drain Cleaner, 7½ ft. length.

Name.....

Address.....

City..... State.....

**\$2.50**

for 2½-ft. length.

Family size, 7½-ft. length, \$3.95.





## HOW TO OBTAIN SHOP TOOLS

at the earliest possible moment and  
**PAY FOR THEM OUT OF  
PATRIOTIC SAVINGS  
IN WAR BONDS**

Ours versatile, low-cost, sturdy

**Boice-Crane**

Band Saws - Saw Jointers  
Jig Saws - Spindle Shapers  
Belt Sanders - Spindle Sanders  
Drill Presses - Lathes  
Thickness Planers

Write today for folder on the

**Boice  
Crane**

## PURCHASE PRIORITY PLAN

a safe, convenient plan for forward-looking  
shop men and home craftsmen.

With manufacturers now engaged 100%  
in war production, the pent-up demand for  
shop tools is tremendous. You can avoid  
prolonged waiting for your tools, or the  
necessity of buying something less satisfac-  
tory, by reserving a preferred delivery  
position now. Use this convenient coupon  
to get details.

**BOICE-CRANE CO.**

944 Central Ave., Toledo, Ohio

Please send, without obligation or cost, details of the  
Boice-Crane Purchase Priority Plan, together with a  
copy of your catalog on shop tools.

NAME \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_

## BENJAMIN



### H-C PELLETS ARE AVAILABLE

at dealers or direct. Cal. .22 and Cal. .177. Production of  
all models Benjamin Air Rifles and Benjamin Air Pistols  
has been suspended for the duration as our facilities are  
engaged in War Work. **WRITE FOR OUR ILLUSTRATED  
PRICE LIST and BUY MORE WAR BONDS.**

**BENJAMIN AIR RIFLE CO., 311 Marion St., St. Louis, (4) Mo.**



## Choose Your ARC WELDER

Compare features by feature and you'll choose  
Hobart on its exclusive features a one for  
Hobart a truly "Simplified" yet achieving has  
been a standard. Hobart is showing quality built  
welder made to do every welding job better.  
They and are now a way plan's speeding  
work making stronger products. They can do  
the same for you.

**HOBART**  
"SIMPLIFIED"  
ARC WELDERS

PLAN NOW! Design for Post-War  
made easier with Hobart's new  
"Practical Design for Arc Welding"  
Ask to be placed on the mailing list  
to receive this free design service.

HOBART BROS. CO. Box P-24 Troy, O.

HOBART "One of the World's Largest Builders of Arc Welders."

## TOOLS TO FINISH THE JOB!

### 20 CARBON DRILL SET

Water-Thin Vest Pocket Case

Drills No. 41 to  
No. 60. A craftsman's  
treasure! Indexed  
case! Fast of 34.75  
value! (By mail) \$35.00

**\$350**  
Cash  
value \$1



### 60 CARBON DRILL SET

No. 1 to 60 Complete  
Indexed metal case

Illustrated above! Precision tool outfit! Would cost \$25 if  
assembled individually! Tap & machine screw data & decimal  
equivalents on case. Case alone no drills. \$3.75! Complete  
outfit \$18.75 (By mail) \$19.00 includes postpaid.

**\$18.75**

**NEEDLE FILES.** Fine series type, 4" or 6 1/2" Long. Round, Flat, Oval, Knife, Sq., 3 Sq., Squaring, Barrette, Joint, Slitting, Marking  
No. 40c Complete Set, 12 files, indexed holder \$4.50.

#### CARBON DRILLS

41	to	60	ea.	15c
41	to	60	ea.	20c
41	to	60	ea.	25c
41	to	60	ea.	30c
41	to	60	ea.	35c

#### HI-SPEED DRILLS

1/8" 3/16"	17/64 1/4"
1/2 3/4"	1 1/4 1 1/2"

#### PIN VISES

Lat. wood handle	\$1.25
4 Jaw double chuck	
Takes 40 to 80	\$1.00
Small, 4 Jaw brass	
handle, to 80	\$5c

#### TWEEZERS

Holds small Parts	50c
Larger Sure-grip	65c

#### OCULISTS SIZE TAPS

0-45	0-53	ea.	40c
<b>CARBON TAPS</b>			
0-80	0-85	8-12	45c
2-68	0-85	1-72	50c
4-40	0-85	3-48	60c
Dns. \$1.00			
<b>TAP WRENCH</b>			
1/16-9/32			\$1.25
with ratchet			\$2.00
<b>TAP CHUCK</b>			
13/16 rd. drive			\$1.00

**INTERNATIONAL MODELS 254 (P) W. 55th St., New York**  
19, N.Y.

## GLIDER BLUEPRINTS



1. UTILITY TRAINER—2 PLACE 2. PRE FLIGHT  
TRAINER 3. PRIMARY GLIDER 4. HIGH PER-  
FORMANCE SOARING GLIDER Engineered,  
carries CAA, NR license. Reasonable. Write  
for free 3-view prints.

**CALIFORNIA AERO GLIDER CO., INC.**

Dept. P-2, 1829 W. 62nd St., Los Angeles 44, Calif.



## OTTAWA TRACTOR SAW

**Falls Tree—Cuts Log**

Uses Power Take-off any tractor.  
Direct drive. Long stroke. Saws fast.  
Easy on fuel. Thousands of satisfied users.  
Buy labor saver. Low in Price.

Write for FREE  
Book and Prices

**OTTAWA MFL CO., 6201 Forest Ave., OTTAWA, KANSAS**



## WILL YOU WEAR THIS SUIT

**and Make up to \$12 in a Day!**

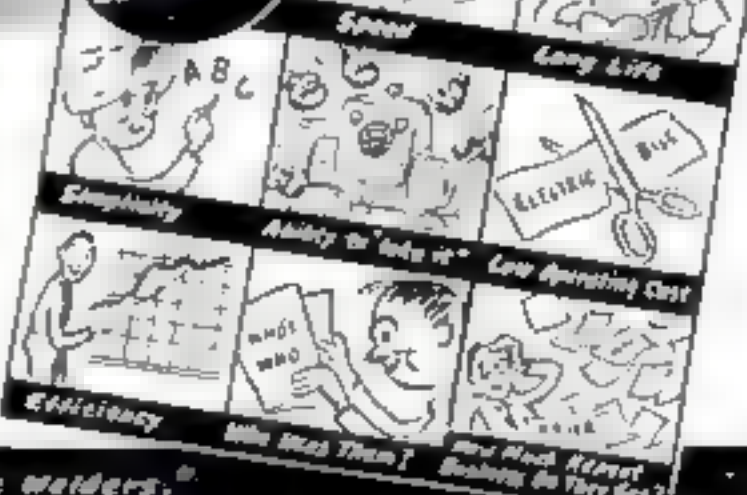
Let me send you a union tailored to measure suit FREE  
AS A BONUS. Just follow my easy plan and take a few  
orders. Make up to \$12 in a day easily. No experience  
—no house-to-house canvassing necessary. Big oppor-  
tunity—full or spare time.  
Send for Samples FREE OF COST. Write today for  
FREE ACTUAL COTTON HAMPERS and sure fire money-  
getting plans. For quick act on write fully giving age,  
etc. Send no money. **M. J. Collin PROGRESS TAILOR-  
ING CO., 800 So. Throop St., Dept. B-221, Chicago, Ill.**

WHEN YOU BUY FLASHLIGHT BATTERIES ASK FOR

## "EVEREADY" FRESH DATED BATTERIES

The word "Eveready" is the registered trade-mark of National Carbon Co., Inc.

by choosing  
it for these  
5 VITAL  
ESSENTIALS





# BETTER RAZOR BLADES

... means **STEEL** for **VICTORY!**

Ask the men in the steel rolling mills and they will tell you the importance of *precision* in the making of "razor blade" steel. **PROFESSIONAL** Blades combine the finest quality steel . . . special razor blade processing . . . together with the skill of highly trained metallurgists and razor blade craftsmen to give you a blade unique in shaving performance.

**PROFESSIONAL** Blades assure more longer-lasting shaves because they are precision-made and tested in every detail—from steel mill to the finished blade.



**Professional**  
PRECISION MADE • RUST RESISTANT  
**BLADES**

PROFESSIONAL BLADE CO. 22 GREEN STREET NEWARK 2 NEW JERSEY

Do you know what makes this  
**DURO 6" Jointer**  
*the most efficient in its field?*

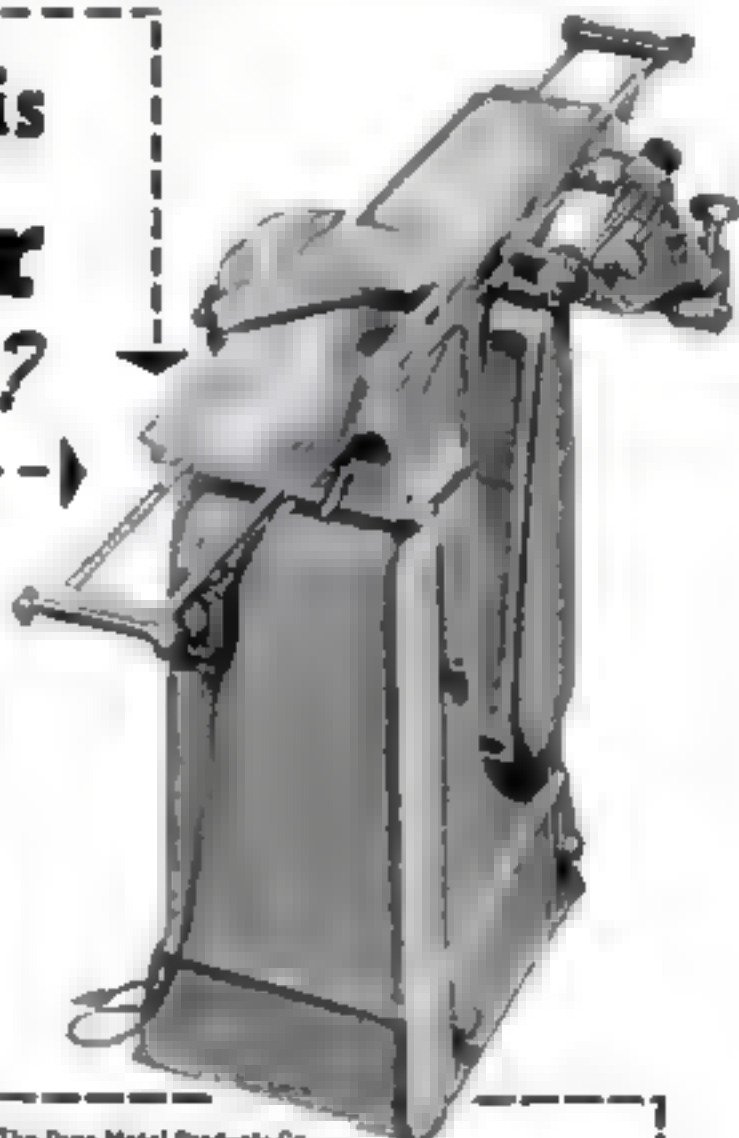
The DURO 6-inch Jointer has been acclaimed by men who use it as one of the finest jointer values on the market! Here's why: It has many exclusive features such as front and rear blade guards, extensions to increase support of work to 60", fence that eliminates dangerous gap over rear table, New Departure Ball Bearings. Cuts to 1/2" depth on material 6" wide. Has many other unusual features.

**SEND FOR LATEST DURO CATALOG . . .**

For full details and prices on the DURO 6" Jointer send for latest DURO CATALOG using coupon below. Also lists specifications and prices of complete line of DURO single and multi-spindle Drill Presses, Circular Saws, Jointers, Routers, Shapers, Grinders, Lathes, Scroll Saws, Flexible Shaft Units and Portable Electric Drills.

## DURO TOOLS

MACHINE TOOL DIVISION  
ALSO MAKERS OF DURO HAND TOOLS



The Duro Metal Products Co.,  
2435 N. Kedzie Ave. Chicago, Illinois  
Gentlemen, Please send me **FREE** copy of  
latest DURO Catalog giving specifications  
on new DURO 6" Jointer and other DURO  
Machine Tools.

Name . . .

Address . . .


City . . .

Zone . . .

State . . .



**SOLEMNIZE THE EVENT WITH**



**Lovebell**


**WARRANTED DIAMOND ENGAGEMENT and WEDDING RINGS**

A lifetime of love... for the girl who wears LOVEBELL rings with pride and confidence. Lovebell is the symbol of her happiness... and his good taste.

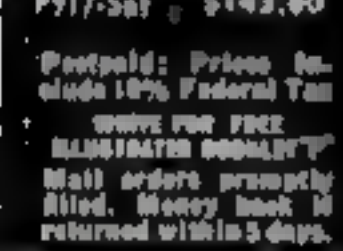
**GUARANTEE**  
The LOVEBELL Certificate Of Guarantee is your warranty of value and highest quality. LOVEBELL diamonds are noted for clear color and fine cut. LOVEBELL rings for beauty of design.



P816-Engagement Ring ... 39.00  
P716-Wedding Ring ... 6.75  
P916-Set ... \$45.75



P817-Engagement Ring ... 55.00  
P717-Wedding Ring ... 7.50  
P917-Set ... \$62.50



P818-Engagement Ring ... 114.00  
P718-Wedding Ring ... 27.00  
P918-Set ... \$141.00

Postpaid: Prices include 18% Federal Tax  
WRITE FOR FREE ILLUSTRATED CATALOG  
Mail orders promptly filled. Money back if returned within 5 days.

**LOVEBELL**  
Division of  
**BELL WATCH CO.**  
Time and Life Bldg.  
Rochester Center N. Y.

## PRECISION GAGE BLOCKS

Indispensable in interchangeability manufacture in testing and setting tools to checking in comparators. ULTRA-CHEK are now available in nine block sets as illustrated.

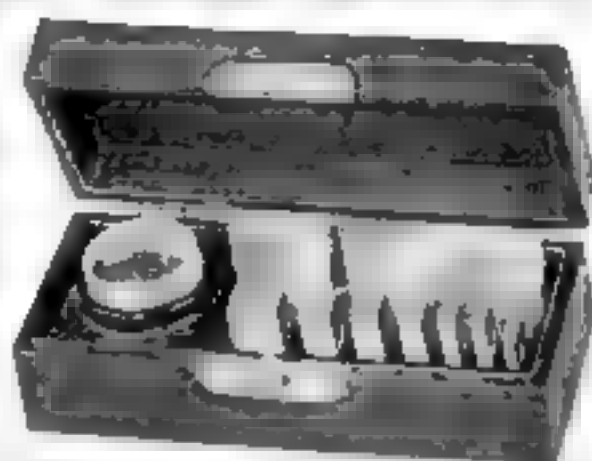
Every toolmaker and mechanic can now afford his own set of gage blocks. Order now to turn out highly precise work—reduce rejections, save material.

The ULTRA-CHEK set consists of the following blocks: .0625", .100", .125", .200", .250", .300", .500", 1", 2" enabling you to make up 211 combinations.

BECOME A BETTER CRAFTSMAN BY ORDERING ULTRA-CHEK NOW!

Price with optical flat **\$27.50** Price without flat **\$19.50**  
ASK FOR NEW FOLDER "THE USE OF GAGE BLOCKS"

**GEORGE SCHERR CO.** 128PS Lafayette St.  
New York 13, N. Y.



## HOLD-E-ZEE AUTOMATIC GRIP SCREWDRIVERS

Hold, start and set up  
no hand work  
spring action  
easy to use  
no need for  
special tools

No more  
expensive  
drill bits  
drill in a  
second  
HOLD-E-ZEE  
day at hardware  
supply or electrical store

UPSON BROS. INC. 84 EXCHANGE ST. ROCHESTER, N. Y.

## BUILD YOUR OWN ARC WELDER

for Light or Heavy Work  
No wiring necessary. Use in  
home or shop. Easy to use.  
Welds all metals. No need for  
gas or electrodes. No need for  
LEJAY MFG. 3323 Lacey Bldg. Minneapolis, Minn.



## SAVE RUBBER

Fast to fix cuts, bruises, worn spots in tires.  
SOLO also mends shoes, raincoats, boots—any  
thing made of rubber, leather, cloth.



**MEND the HOLE for 1¢**  
SPREADS ON like butter. Dries  
tough overnight. Flexible. Non-  
skid. Waterproof. Won't come  
off—guaranteed.  
**So-Lo** AT HARDWARE & HOME STORES

## Asthma Mucus Loosened First Day For Thousands of Sufferers

Choking, gasping, wheezing spasms of Bronchial Asthma rule sleep and energy. Ingredients in the prescription Mendaco quickly circulate through the blood and commonly help loosen the thick strangling mucus the first day, thus aiding nature in palliating the terrible recurring choking spasms, and in promoting freer breathing and restful sleep. Mendaco is not a smoke, dope or injection. Just pleasant, tasteless palatable tablets that have helped thousands of sufferers. Iron clad guarantee—money back unless completely satisfactory. Ask your druggist for Mendaco today.

## WAR WORKERS—WIN "PRODUCTION AWARDS"

Dremel Moto-Tools are used on hundreds of jobs in thousands of war plants, because they are such great time and labor savers. Sharpening tools... cleaning dies... casting cores and welding points... grinding, polishing, boring and finishing... there are but a few of Moto-Tool's many capabilities. Only Moto-Tool has all these features: 17,000 r.p.m. (assures better work and lengthens life of cutters), shockproof (bake life case all heat-treated) bearings, fan-cooled motor (can't overheat). Order Moto-Tools and Accessories at your dealer or direct on 10-day trial. Money-back guarantee. If you need a Moto-Tool ask your employer for proper priority Catalog FREE.

—Suggest Dremel  
**MOTO-TOOLS**

TO SAVE TIME—  
CUT COSTS AND  
SPEED PRODUCTION

**RADIO OPERATORS WANTED**

Learn to Send and Receive Radio Code at home or in camp or prepare for higher proficiency and rating through easy system used in training radio telegraph operators. Thousands of operators needed. Write for FREE CATALOG  
**CANDLER SYSTEM CO.**  
Dept. 8-B Box 928 Denver, Colo., U. S. A.



Kit No. 1 with 23 high grade accessories and Motor Moto-Tool in hard case **\$17.50**  
Kit No. 2, same as above with Master Moto-Tool **\$23.50**

**DREMEL MANUFACTURING CO. Dept. T-124-B RACINE, WISCONSIN**



# YOU CAN EASILY MAKE Telescopes—Magnifiers—Photographic Gadgets and HUNDREDS of EXPERIMENTS with LOW COST LENSES

Big 10 Page Project and Idea Booklet with all sets—describes successful developments—points the way to new experiments.

ALL LENSES NEW, finely ground and polished, edges very slightly chipped—A SALVAGE BARGAIN!

Set No. 301-N "Our Advertising Special" 15 Lenses for \$1.00 Postpaid. For making your own powerful telescopes, strong magnifiers, photo cell's rifle scopes, photo lens dummy focusing camera Kodachrome viewer stereoscopic viewer ground glass and enlarging focusing aids. For experimental optics portraits of babies and small pets, copying, ultra close-up shots, and many, many other uses.

Set No. 302-N "The Gadgeteer's Delight" 35 Lenses for \$5.00 Postpaid. Contains all the lenses in the above set plus twenty more expensive lenses increasing your field of experiment and gadget making. All our lenses are neatly packed and marked.

Set No. 310-N "The Experimenter's Dream" 60 Lenses and New Complete 80 Page Booklet—\$10.00 Postpaid. Contains all the lenses in the above sets plus 25 others that makes this a sensational buy. The variety of lenses in this set will enable you to conduct countless experiments and build a wide variety of optical equipment.

## JUST COMPLETED!

80 Page Illustrated Idea Booklet "Fun With Chipped Edge Lenses" Only \$1.00. The Complete Hand Book describing a wide variety of exciting experiments and valuable optical devices you can build.

PRISMS! \$1.00—\$1.35—\$2.25

Set of 3 of the above sizes complete \$4.50

Limited Number! Hurry!

EDMUND SALVAGE CO.

27 W. Clinton Ave., Dept. 10, P. O. Audubon, N. J.

# BUILD YOUR OWN TRACTOR



## FROM OLD AUTO PARTS

Now anyone can build a tractor from old auto parts. This tractor is built from old auto parts. It is a simple tractor that can be built from old auto parts. It is a simple tractor that can be built from old auto parts.

SEND ORDER TODAY. Complete plans, parts list and instruction book, only \$1.00 postpaid. Money-back guarantee.

SCIENCE AND MECHANICS, 154 E. Erie St., Dept. M 100, Chicago 11

# 730 SHAVES FROM 1 BLADE



## AMAZING NEW BLADE SHARPENER

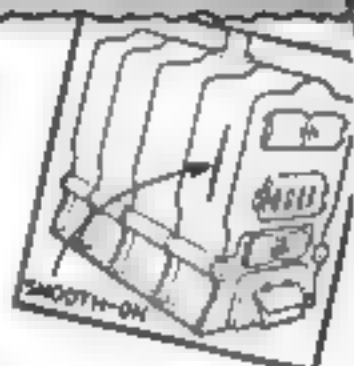
New sharpener for all makes of straight edge razor blades. Performs miracles! "Not necessary to change blade," writes one user. Another says, "Have used 1 blade over 700 times." RAZOROLL really sharpens blades because it strokes the leather. Gives keen, smooth shaving edges. No frame-work. Blade held at correct angle and proper pressure—automatically. Just turn crank to sharpen blade. No gears. Well made. Handmade, rotomold, sturdy. Weighs few ounces. Will last years. Makes ideal gift.

SEND NO MONEY! Write today. Pay postage only \$1 plus few cents postage. Use RAZOROLL for 5 days and if you're not delighted with smooth, velvet shaves you get, return RAZOROLL and we'll return your dollar. Hurry—order today. RAZOROLL COMPANY 620 North Michigan Avenue, Dept. 292, Chicago, Illinois

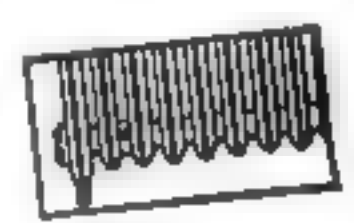
**SIGNS EASILY AND EXPERTLY**  
**PAINTED WITH LETTER PATTERNS**  
**AND SHOWCARDS**  
MANY SIZES & STYLES  
WRITE FOR FOLDER  
JOHN F. RAHN  
1330-33 N. CENTRAL AVE.  
CHICAGO 51, ILL.

# Now! Tune Up Your Heating System for Winter...with SMOOTH-ON

Don't put it off. Stop those leaks—seal up cracks—tighten joints—do it promptly, easily, effectively, inexpensively, with famous Smooth-On No. 1 Iron Repair Cement. Famous because professional repair men have depended on it for close to half a century.



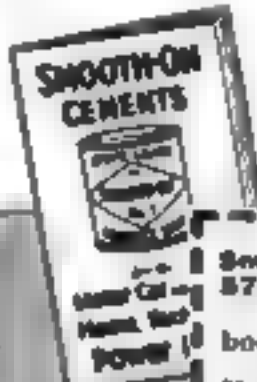
Now—when getting new equipment is out of question—get your furnace, boiler, hot water tank, piping, radiators ready for the cold weather ahead. Don't wait until trouble starts.



Any householder can use Smooth-On. No heat required. Goes on like putty, hardens dependably. Will do countless other home repair jobs—tightening loose fixtures, handles, screws, bolts, knobs, pulls, casters, etc. Your neighborhood hardware store sells Smooth-On. Keep a can handy for emergencies. Buy in 1 1/4-oz., 7-oz., or 1-lb. container from your hardware store or, if necessary, from us.



# FREE Handbook on Home Repairs



40 pages of simplified instructions, money- and time-saving short cuts. Pocket size, 170 clear-cut diagrams. Handy Index. Send now for your copy.

MAIL THIS TODAY

Smooth-On Mfg. Co., Dept. 5E, 570 Communipaw Avenue, Jersey City 4, N.J. Yes—please mail me my Smooth-On Handbook.

Name..... Address..... 2-44

# Do it with SMOOTH-ON



*For Men Who Really Know Pipes*

# Royalton

Some men select a pipe for style alone. Others by lure of price. But among men of sound judgment, smoking satisfaction is the prime consideration. Their preference is Royalton—for they know the deeper contentment and enduring pleasure that this pipe always brings.

**ROYALTON \$5**  
Silver Crown  
Choice Natural Grain

your dealer is short of Royaltons, remember that great numbers of them are going to men in our fighting forces.



© 1942. Henry Leonard & Thomas, Inc. State Pl. N. Y.

**"Good Pictures" BRING YOU TOGETHER**

AWARDED TO PLANT 3 OFFICIAL DIVISION

FROM snow to sunshine there is no closed season for Good Pictures. To your soldier or sailor doing his duty "over there" your pictures are the visual symbols of the things he loves.

**"Good Pictures"**

This 36-page booklet is published by Argus to help solve the problems of exposures, lens, films, etc. Get your copy by sending 25c to Argus, Ann Arbor, Michigan, Dept. 5.

**argus**  
INTERNATIONAL MARKETING, INC.



# UTICA TOOLS



ALL TYPES FOR MORE TOOL MILEAGE

Ask Your Dealer

**UTICA** DROP FORGE & TOOL CORP.  
★ UTICA, N. Y. ★

# WOOD WORKERS

Amazing BOOK for You

only 10¢

CHAPMAN WOOD SERVICE CO.  
7725 S. May St., Dept. B 47, Chicago 5, Ill.




# New Catalog

GENUINE U. S. BARGAINS

- U. S. Wool Blankets (used) \$2.95
- U. S. Army Station Bags (New) .45
- U. S. Army Pup Tents (used) 3.50
- Slightly Used Army Canteen Wheels with Axles, 55" high, Wt. 322 lbs. \$37.50

Thousands of other bargains in military, outdoor & sport goods for hunter, farmer, scout. Send 10¢ for 25 page catalog returned with first order.

**A and N SUPPLY CO.**  
4704 LESTER ST. RICHMOND, VA.



# OTTAWA LOG SAW

Write for FREE BOOK

PUT THIS OTTAWA to work for you. MAKE MONEY! Wood is valuable. Does more than 10 men. Easily operated. Handles trees and saws into two 6-hp. engines for other work.

SAW 10 to 20 CORDS A DAY

**OTTAWA MFG. CO.**  
201 Wood St. Ottawa, Kans.



# GRAY HAIR VITAMIN

No dyes—No drugs—Hair grow out in Natural Color in almost nine out of ten test cases just adding Calcium Pantothenate Vitamin to regular diet.

**NOW \$1.95** Pay No More

**WHY PAY \$3.50 TO \$5.00**

for the famous "Gray Hair Vitamin" when you can buy 100—10 mg. tablets of genuine Calcium Pantothenate—same as used in National tests—by mail for \$1.95. SEND NO MONEY. Just send name and address on penny postcard. We will ship 100—10 mg. tablets C O D for \$1.95 plus few cents postage. If not completely satisfied with quality return package within ten days for immediate refund of your money. Address: Liles Products Co., 2017 S. Michigan, Dept. 182, Chicago

# LEPAGE'S GLUE

LEPAGE'S MODEL AEROPLANE GLUE  
LEPAGE'S LIQUID SOLDER





# Blatz

# Beer

Fast Becoming  
AMERICA'S NEW  
FAVORITE

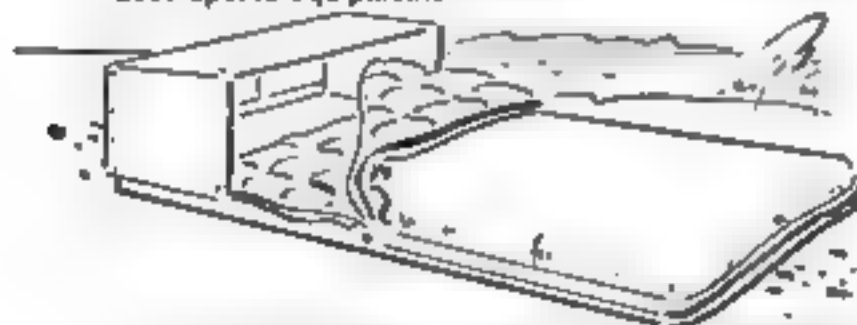
MILWAUKEE'S MOST EXQUISITE BEER  
BLATZ BREWING CO., MILWAUKEE, WIS.

In Our 93rd Year

BUY WAR BONDS



In a soldier's sleeping bag weight and bulk must be reduced to the very minimum without sacrificing warmth and comfort. When your sporting goods dealer shows you the after-war Ta-Pat-Co you'll see how completely it fills these requirements for our fighting forces. And of course you'll immediately want to add one of these lighter, warmer, more compact sleeping bags to your outdoor sports equipment.



THE AMERICAN PAD AND TEXTILE COMPANY

In peace and in war the leading manufacturer of  
Sleeping Bags and Life-Save Equipment

FEBRUARY, 1944

Buy War Savings Bonds and Stamps regularly.

241

## FREE! LATEST, MOST COMPLETE RADIO PARTS CATALOG



EVERYTHING in RADIO and  
ELECTRONICS for War Train-  
ing, Maintenance or Repair

It is the most complete, up-to-date BUYING GUIDE available! It contains latest "supply data" on radio and electronic parts available without priority for repair and replacement—plus everything in war training kits, books and equipment! Whatever you need—you'll save time by getting in touch with ALLIED first. Send for this big free catalog today.

### RADIO'S FINEST BOOK VALUES

Specially prepared to aid radio training in schools and industry. Full of valuable data. Send for all six!

Radio Formulas and Data Book No. 37-752...10c

Dictionary of Radio Terms No. 37-751...10c

Radio Circuit Handbook No. 37-753...10c

Radio Builders' Handbook No. 37-750...10c

Simplified Radio Servicing No. 37-755...10c

Radio Data Handbook No. 37-754...25c

All Six Books No. 37-799...75c

ALLIED RADIO CORP.

833 W. Jackson, Dept. 7-B-4, Chicago 7



## ALLIED RADIO



## ANYONE, ANYTIME CAN MAKE PHOTO-COPIES QUICKLY

The most  
USEFUL  
copying method  
ever perfected



A P E C O  
PHOTO COPIER  
\$55.00

The accuracy, ease and speed with which A P E C O photo-copies are made by anyone, are creating hundreds of new users. This modern, versatile, low-cost method makes photo-exact copies of anything written, printed, drawn or photographed. Experience proves that A-P-E-C-O quickly pays for itself.

### LEGALLY ACCEPTED PHOTO-COPIES OF

- Letters • Records • Blueprints • Shop Orders
- Pictures • Receipts • Drawings • Documents

Same-size copies of anything up to 18" x 22". Eliminates errors. Saves stenography, tracing, proofreading. No camera, focusing, film or moving parts. Any employee quickly becomes expert. Lowest investment in equipment. Use on any desk or table. You need A-P-E-C-O. Let us show you how you can use it to expedite office and shop copying. Immediate delivery. See why thousands are in satisfactory use. Send for A-P-E-C-O folder—today.

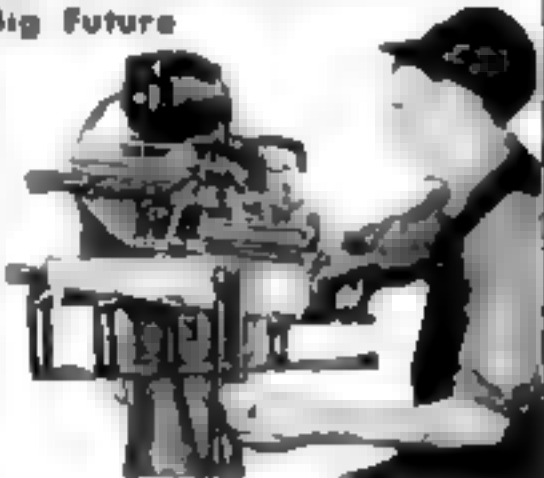
**AMERICAN PHOTOGRAPHY EQUIPMENT CO.**  
2849 No. Clark St. Dept. MU-2 Chicago 14, Illinois  
Representatives in principal cities and Canada.

FIGHT WITH WAR BONDS

## FREE PLAN!

Shows how to Start a Good War-Time  
Business with a Big Future

There are hundreds of ways to get rich in the war-time business. But the need for a business is not met. Our FREE PLAN shows how to get rich in the war-time business. With a Free Automatic Saw Filer you can file saws faster and better than the best hand filer and earn up to \$2 or \$3 an hour. No investment. One machine no files. All saws hand hand or circular. No special priority application required. Delivery guaranteed. Get info



## SAW-FILING

now there is plenty of business during wartime—and be all set for the big building boom which is sure to come when the War is over. Send coupon today for FREE PLAN—no obligation—no salesman will call.

**FOLEY MFG. CO.,** 219-4 FOLEY BLDG., MINNEAPOLIS 13, MINN.  
Please send FREE PLAN on saw filing business.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_

## DRILL PRESS OWNERS!

HERE'S 1 TOOL WITH 5 DISTINCT USES



THE BARRON MULTI-PURPOSE  
ROTARY WOOD PLANER

PLANES & SURFACES • PROFILES & BEADS • ROUNDS & GROOVES • RABBETS • TENONS **\$750** COMPLETE

Converts ANY drill press into a time saving, low cost planer, sander, tenoner, etc. Surface finishes all types of tough grained and knotty surfaces to agree smoothness. Safe! Guaranteed harmless to drill press. Thousands now in use. **SOLD ON MONEY BACK GUARANTEE.** Full refund on 3 day trial. Shipped prepaid on receipt of \$7.50. or C.O.D. YOU RISK NOTHING. Free literature.

### STEEL TOP AUXILIARY DRILL PRESS TABLE

Max 300 sq. in. smooth working surface. Equipped for shaper and many other important workshop uses—a real buy at **\$595**



**BARRON TOOL CO., INC.**  
370 Architects Bldg., Detroit 2, Mich.

NOW...A RECHARGEABLE

## FLASHLIGHT BATTERY

OUTLASTS 800 DRY CELLS

POPULARLY  
PRICED

YES, IT'S TRUE! One VICTORY Flashlight Battery will give a brighter light, and from 3 to 5 times longer life than dry cells. When exhausted, may be recharged over night. One VICTORY Battery equals in overall life about 100.00 worth of dry cells. A wartime necessity. Fits any flashlight. Limited supply available for civilian use without priority.

**THE AUTOMATIC ELECTRICAL DEVICES CO.**  
28 EAST THIRD ST., CINCINNATI 2, OHIO

ANYONE CAN  
DO THIS IF

THEY HAVE  
OUR CHART

Blue Print 27" x 36" shows how to find length of any rafter, find any angle in degrees, frame any polygon 3 to 16 sides, read board foot and brace tables, octagon scale, rafter tables and many other uses. Can be scaled down for model work as well as full scale framing. Also chart changing pitches to degrees for use with Radial Saws. Send 50c in coin or money order. No stamps or checks.

**MASON & PARR ENGINEERS**  
3108-S N. Burdick St. Dept. M. Ann Arbor, Michigan

SPECIAL  
OFFER  
FOR  
AGENTS

## MAGIC LIQUID MAKES PHOTOS APPEAR

On Scarfs, Ties, Stationery, Etc.

Reproduce any snapshot on cloth, leather, wood, paper. Simply apply liquid. Like magic photo appears within 5 minutes in bright daylight. Harmless to negative. Won't wash off. Full colors included. Complete kit for 100 photos only \$1.25. Send no money. Just name. Pay postman \$1.25 plus low cost postage on delivery. Canada, \$1.50 money order only. Order today.

**L & M Mfg. Co., Dept. 200, Nerve Bldg., Cincinnati 2, Ohio**



## don't WORRY

Why put up with years of needless discomfort and worry? Try a Brooks Automatic Air Cushion. This marvelous appliance permits the opening to close, yet holds reducible rupture securely, comfortably—day and night. Thousands report amazing results. Light, neat-fitting. No hard pads or stiff springs to chafe or gouge. Made for men, women and children. Durable, cheap. **Send on trial to prove it.** Never sold in stores. Beware of imitations. Write for Free Book on Rupture, no-risk trial order plan, and proof of results. All correspondence confidential. **BROOKS COMPANY, 166-C State St., Marshall, Mich.**



ABOUT  
RUPTURE



# INTRODUCING-New Victory Model HANDIWELD ELECTRIC ARC WELDER



RETAILS  
ONLY  
**\$1.95**

## PLUGS INTO LIGHT SOCKET

Victory Model Handiweald Arc Welder operates from 110 volts, A.C. or D.C. current same as other arc welders higher priced, generates tremendous heat to weld all metals. Not a toy welder that uses carbons but actually uses standard coated rods—sizes 1/16" and 3/32". However, due to Prioritas a generous supply of 1/16" rods only are supplied with the welder. (Carbons not to burn out). Repairs fenders, auto bodies, radiators, machinery parts, etc. Take Victory Model Handiweald anywhere to job, operate right

from light socket. You'll find a thousand uses for this welder around your home, garage, workshop. Also in garages, factories, repair shops, tin shops, mechanics, inventors, plumbers, farmers, etc. Order a "Victory Model" Handiweald now. **SEND NO MONEY**. We'll rush one to you with rods, helmet, operating instructions, and all necessary parts with the exception of a large jar and a small piece of extension cord, these most everyone has. Pay postman only \$1.95 plus a few cents postage. If not delighted return Victory Model Handiweald in 5 days from receipt and money paid for it will be refunded. Rush at 1. Rush your order to

**KUMFY PRODUCTS Dept. A-205, Cincinnati, Ohio**

# STOP RADIO STATIC

The ALL WAVE radio filter is guaranteed to help you get perfect radio reception. Eliminates all hums, clicks, crackles, etc., caused by electric razors, vacuum cleaners, motors and other electrical appliances. The ALL WAVE is a scientific and compact radio filter that can be used on any make electric radio. To connect, just put your radio plug thru the ALL WAVE's slotted opening and into any wall outlet. **15 DAY FREE TRIAL**. Sent C.O.D. for \$1.50 plus postage. Cash orders sent postpaid. Rush order supply limited. **Vogue Eliminator Co., 7738 N. Halsted, Dept. AW 110, Chicago 20, Ill.**



## MODEL CRAFTSMAN



## MODEL Railroads-Aircraft-Racers Ship Models-Shop Practice

Devoted to model building, operating, racing, exclusively! Numerous construction projects for advanced or beginner. Profusely illustrated, detailed building plans. If sold out at news-dealers or hobby shop, only postpaid.

**Special 5 MONTHS for only \$1.00**

Order at MODEL CRAFTSMAN (Dept. P) Ramsey, N.J.

## Burpee's GIANT ZINNIAS

Dahlia-Flowered  
Scarlet, Lavender, Yellow  
and Rose 5 inches across.  
Easy to grow. The four best  
colors, a 15c-Pkt. of seeds  
of each, 60c value, all 4 postpaid  
for just 10c. Send dime today!

4 PACKETS  
**10c**

Burpee's Seed Catalog Free-Flowers and  
Vegetables for your Victory Garden.  
**W. ATLEE BURPEE CO.**  
Philadelphia 32, Pa. or Clinton, Iowa

## CRAFTSMEN Get this BOOK OF MATERIAL, SUPPLIES & TOOLS... STILL AVAILABLE

Full of valuable hints and short cuts plus catalog of a surprisingly complete list of materials, tools and supplies. Features Identification Paper and Chart of over 80 Rare Woods in Natural Color plus full color showing of over 80 alloy borders in natural color. Send only 25c, stamp or coin, which is refunded on first order of \$1.50 or more, making this valuable manual cost you nothing.

**ALBERT CONSTANTINE & SON, INC.**  
7935 East 125th St. New York, New York

## America's War Made Industry—

# ELECTRICAL APPLIANCE REPAIRING



## OFFERS BIG MONEY—INDEPENDENCE

The restrictions on the manufacture of electrical home appliances has greatly increased the need for and earnings of skilled home appliance repairmen. Always a good business, today **ELECTRICAL APPLIANCE REPAIRING** is one of the most profitable occupations that the average mechanically inclined man can turn to. On many types of repairs it is usual for a repairman to charge on the basis of \$5.00 to \$6.00 an hour! Work as many hours as you wish—for the home appliance repairman is his own boss. Operate from your garage, basement, vacant store, etc.

## NEW COURSE TELLS ALL

If you are at all mechanically inclined—can hold and use tools—you have all of the qualifications required for becoming a big money-earning home appliance repairman. Age is no barrier . . . nor is any minor physical handicap. Our new course is profusely illustrated, shows you in simple, easy to understand language and drawings how to make each repair on refrigerators, vacuum cleaners, washing machines, motors, etc. Explains and gives you a working knowledge of electricity, welding, nickel plating, etc. Shows you how to build the power tools you need and how to solicit and keep business coming to you. Not a theory course but an honest to goodness course written by and used by repairmen the Country over. Price of course is so low that the savings on your own household appliance repairs will quickly pay for it. Act now!

## Mail Coupon for FREE LITERATURE

**CHRISTY SUPPLY CO.**  
2834 N. Central Ave., Dept. D-1301  
Chicago, Illinois

Please send me all the facts about America's Fastest Growing Industry—Electrical Appliance Repairing.

Address.....  
City..... State.....



make Models with KEENER  
safer, FASTER  
X-acto knives!  
You, too,  
will be an EXPERT modeler



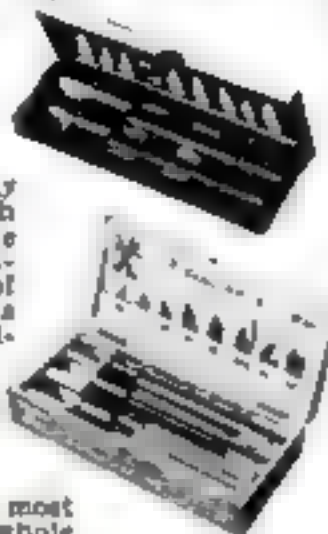
The Navy and the Army, too, need thousands and thousands of authentic scale models of all ed and enemy planes for teaching quick identification. Use X-acto knives to speed up this production.

### Make Model Planes for Uncle Sam!

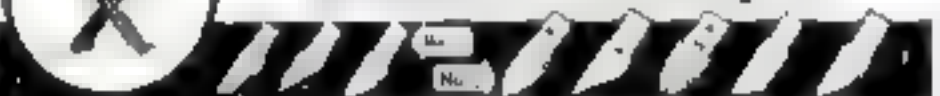
No other knife at any price has all the rich features that make X-acto the undisputed first choice of model makers. Its super-keen surgical-steel blades (just re-blade to re-sharpen), and the scientifically shaped blades in eight styles, give the craftsman the most versatile tools of his whole outfit. With these amazing knives, you increase output and improve accuracy.

KIT NO. 62 Double set with 2 handles 12 blades \$2.00  
KIT NO. 62—Furnished with 3 handles 12 blades and fitted wooden chest \$3.50

FREE—with your order 32 page Manual "How To Build Model Planes"



**X-acto KEENER KNIFE**  
RE-blade to RE-sharpen



At Your Hobby Dealer's, Hardware or Dept. Store

X-acto Crescent Products Co., Dept. PS  
440-4th Avenue, New York 18, N. Y.  
Send X-acto checked invoice \$1.00 32 page Manual "How To Build Model Planes" X-acto and X-acto desired:  
Chest No. 62 \$3.50 Set No. 62 \$2.00 No. 11 light with one blade for No. 12 heavy with one blade for No. 12 with 5 extra assorted blades \$7.00 I will pay postman \$1.00 as postage and C.O.D. fee by remitting with order.  
Name \_\_\_\_\_  
Address \_\_\_\_\_

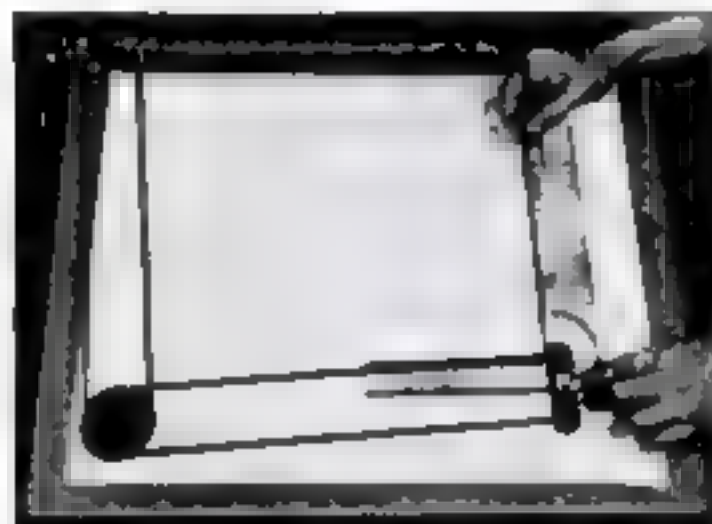
CRAFTSMEN—STOP RUST WITH

## FIENDOIL

Protect tools clean and coat them with this anti-corrosive favored for years by gun and tackle users. Get it now at your Sports or Hardware Store.  
2 oz. Bottle—33c

MCCAMBRIDGE & MCCAMBRIDGE CO.  
Baltimore

## MASTER DRAFTING MACHINE



● Biggest timesaver for dimensioned sketches, lettering and layouts ever sold at—This Low Price—While they last. Limited Supply...only

**\$3.95**

ORDER TODAY

**RANDOLPH RADIO** 611 West Randolph St. CHICAGO, ILLINOIS

## CHEMISTRY CATALOG 7,000 ITEMS

Everything for the study of Science, Chemistry and Biology. Send 25c for our BIG Catalog describing 7,000 items including materials and apparatus for every scientific need.

STANDARD SCIENCE SUPPLY COMPANY  
1334 North Paulina St. Chicago, Ill.

Only  
**25c**

## LEARN MENTAL TELEPATHY



### STEP AHEAD OF THE CROWD!

ROCKET YOUR AMBITIONS into reality! Get things you want, banish Fear, solve problems quickly! Fascinating methods and experiments. Write TODAY for starting FREE booklet and convincing FACTS. Or send \$1 for 5 amazing lessons and GREAT KEY THOUGHT. Atlantean Guild, Box 582 S. Harrisburg, Pa.

## EYEGLASSES BY MAIL

ALLOW 16 DAYS TRIAL

\$1.95 WRITE TODAY FOR

FREE CATALOG SEND NO MONEY

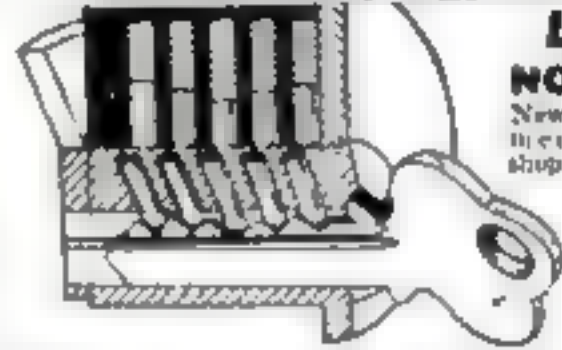
ADVANCE SPECTACLE COMPANY

137 South Dearborn Street

CHICAGO ILLINOIS



DEPT SP 2



## Locksmithing

### NOW MADE EASY!

New course for practical job mechanics, carpenters, etc. Learn to fit keys, pick locks, de-code, make masterkeys. It pays! Head name for FREE details. No obligation—write today. Nelson Co., 321 S. Wabash, Dept. B-753, Chicago.

## JOIN THE MARCH OF DIMES

## FIGHT INFANTILE PARALYSIS

JANUARY 14-31

# LEARN ARC WELDING



— in just a few weeks!

● Learn the practical way, by doing, at one of the country's finest trade schools. Fully equipped to train you to pass tests for profitable war plant jobs.

A NON-PROFIT INSTITUTION backed by a long-time leader in the welding field. Individual booths, machines and instruction. Costs you only for materials used. Train now for this highly essential war work and a promising future.

## The HOBART SCHOOL OF ARC WELDING

HOBART BROTHERS COMPANY  
Box P-241 TROY, OHIO

Send for Complete information Schedules and Prices



HOBART "One of the World's Largest Builders of Arc Welding Equipment."



# KEEP OLD LAWNMOWERS CUTTING with the IDEAL LAWNMOWER SHARPENER

## PERFORM A REAL SERVICE

Keep lawnmowers in service on the home front! Old lawnmowers, like other household equipment, must continue to last so that vital materials can keep flowing to our armed forces. You can keep 'em sharp . . . make old, dull lawnmowers cut like new, and make money too, with the Ideal Lawnmower Sharpener.

Easy to operate, no experience necessary—just set the mower in the sharpener, make a few simple adjustments, the machine does the rest. Sharpens like magic to perfect edge in just a few minutes. Write today for complete details



THE FATE-ROOT-HEATH CO.  
2244 BELL STREET, PLYMOUTH, OHIO

NO EXPERIENCE NEEDED  
EASY TO OPERATE  
KEEN EDGE IN 20 MINUTES



SEND FOR COMPLETE CATALOG  
BUY WAR BONDS . . . AND HOLD THEM!

# SAYS EVERYBODY IS HYPNOTIZED

A strange method of mind and body control, that often leads to immense powers never before experienced, is announced by Edwin J. Dingle, well-known explorer and geographer. It is said to bring about almost unbelievable improvement in power of mind. Many report improvement in health. Others acquire superb bodily strength, secure better positions, turn failure into success. Often, with surprising speed, talents, ability and a more magnetic personality are developed.

The method was found in remote and mysterious Tibet, formerly a forbidden country, rarely visited by outsiders, and often called the land of miracles in the astounding books written about it. Here, behind the highest mountains in the world, Mr. Dingle learned the extraordinary system he is now disclosing to the Western world.

He maintains that all of us are giants in strength and mind-power, capable of surprising feats, from the delay of old age to the prolonging of youth, and the achievement of dazzling business and professional success.

From childhood, however, we are hypnotized, our powers put to sleep, by the suggestions of associates, by what we read, and by various experiences. To realize their really marvelous powers, men and women must escape from this hypnotism.



The method found by Mr. Dingle in Tibet is said to be remarkably instrumental in freeing the mind of the hypnotizing ideas that paralyze the giant powers within us.

A nine-thousand word treatise revealing many startling results of this system is now being offered by the Institute of Mental-physics, 213 South Hobart Blvd., Dept. 648-F, Los Angeles 4, Calif. They offer to send it free to readers of this publication who quickly send their names and addresses. Readers are urged to write them promptly, as only a limited number of the free treatises have been printed.

—(Adv.)



# How 50c a Month Can Pay YOU Up to \$75.00 a Month

This is positively one of the greatest protection values ever offered. Never anything like it before—nothing else like it now! This new 50c a Month Sickness, Accident and Hospital Policy pays graded cash benefits for sickness and accidents, big and small, that happen every day. You receive up to \$50.00 a month for sickness disability, up to \$75.00 a month for accident disability; extra additional benefits for hospital expenses. Up to \$2,000.00 Accidental Death, all benefits as specified in policy. Over \$1,600,000.00 Cash Benefits already paid on Sterling Policies. One low cost of 50c a month to anyone in good health, ages 15 to 69. No medical examination. Get policy for FREE INSPECTION—no cost or obligation. No salesman will call. Write today. THIS OFFER IS LIMITED.

## EXAMINE THIS POLICY FREE

STERLING INSURANCE CO  
153 Jackson-Franklin Bldg., Chicago

Gentlemen: Please mail me at once for FREE inspection your new 50c a Month Sickness, Accident and Hospital Policy. I am not obligated. No agent will call.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Name of  
Beneficiary \_\_\_\_\_

## SHORT of GASOLINE?

Makes your own gas from water and wood, coal or coke to run cars, trucks and tractors. Gas generator easily made for attachment to motor vehicles or stationary power plant. Operate at fraction of usual cost. Build for others at good profit. Complete instructions tell how. Wartime emergency releases this vital knowledge to the public. Only limited edition available. Clip this ad to-day and mail it with \$2 for your copy of GAS GENERATORS FOR AUTOS, TRUCKS AND TRACTORS.

THE MATTHEWS MANUFACTURING CO.,  
DEPT. 110 CALGARY, CANADA



## ITALIAN ACCORDIONS

HAND MADE. Very best. Lowest prices. Buy direct from Factory and Save Money. Send name and address for FREE catalog. ITALIA & P. SOPRANI ACC. MFG. CO. 322 W. POLK ST., DEPT. PS-2, CHICAGO, ILL.



When you buy Northlands you buy the finest—for Northlands are indeed the choice of champions. Whether you are a novice or expert be sure your skis proudly wear the Deer Head trade-mark of NORTHLAND, because the better your skis the better your skiing!

Send 10¢ for Northland Ski Manual  
Edited by Hannee Schneider, 48 pages—82 illustrations  
Or write for FREE folder, HOW TO SKI  
**NORTHLAND SKI MANUFACTURING COMPANY**  
94 MERRIAM PARK SAINT PAUL  
"The World's Largest Ski Manufacturer"

## Gota HOT idea?



### OR A SWELL GADGET?

Let's get together—our Engineering and Production Staff and our Unlimited Financing will develop and promote your brain-child for P. W. P., and arrange for patent. You are fully protected—Specializing in Plastics, Electronics, Metal or Wood. Write Today.

ADDRESS DEPT. G BOX 2745, KANSAS CITY, MO.

Please Mention Popular Science  
Monthly When Writing Advertisers



ILLUSTRATED COMIC BOOKLETS for adults (vest pocket size). The kind you like! 10 different booklets sent for 50c or 25 assorted for \$1. Shipped prepaid in plain wrapper. No C.O.D. orders. Send Cash, Stamps or Money Order. GRAYCO, Dept. A 121, Box 520, G.P.O., New York.



## NOW a DYNAMIC HEAVY DUTY INDUSTRIAL WELDER

Saves  
VALUABLE TIME  
and MONEY!

### AMAZINGLY SIMPLE & EASY TO OPERATE

This portable Dynamic Welder—easily carried right to the job—plugs into any convenient, properly wired 110 volt light circuit—works on Iron, Steel, Brass, Bronze and other metals—has eight metallic and carbon arc welding heat states—does work you would think only possible with a larger, more expensive machine.

### DESIGNED TO DO HIGH GRADE WELDING INEXPENSIVELY

Maintenance Men, Farmers, Mechanics, Machine Shops, Foundries, Auto, General Retail and Job Welding Shops, using the Dynamic find it so indispensable and useful that they cannot afford to be without it. If inexperienced, you can easily learn to do a variety of high grade welding jobs by following the practical, simplified operating and welding instructions furnished.

DYNAMIC WELDER CO., 13-AB East 23rd St., Chicago 16, Ill.

for Only  
**\$23.50**

### COMPLETE

Once you see a Dynamic in operation you won't be without it. Its simplicity will amaze you. In a year the Dynamic only costs you about 8c a day.

Comes complete with helmet, rods, cables, electrode holder and operating instructions, etc.

Write today for free priority assistance and particulars on how to qualify for one of these amazingly low-priced welders. Act now while they are still available. Get details on our 10-day trial offer.



**This One**



**16FU-T5P-23PT**





—easy to clean—unconditionally guaranteed for one year. The crack-proof white surface is bonded to the steel—protects it from rust. 25, 50, 75, 100 ft. lengths. Sold by hardware, building material, mill supply dealers everywhere. Write for folder.

KEUFFEL & ESSER CO., Hoboken, New Jersey



When Writing Advertisers Please  
Mention Popular Science



## RHEUMATISM

**ARTHRITIS - NEURITIS - SCIATICA**  
Why continue to suffer the agonizing pains of these diseases when the usual remedies have failed? Learn about a new trustworthy, modern,

non-surgical treatment method. This marvelous treatment is completely explained in the Ball Clinic's FREE Book. Write today. No obligation. BALL CLINIC, Dept. 5100, Excelsior Springs, Mo.



## WORLD'S LOWEST PRICED ADDING MACHINE

Yest Pocket Size FREE TRIAL  
IDEAL FOR INCOME TAX. GUARANTEED ACCURATE. Not a toy. Operates with only a finger flick. Adds, subtracts, multiplies, divides. Counts up to ten million. Pays for itself over and over. Ideal Gift—for Business, Income Tax and School use. MONEY BACK GUARANTEE. Send name and address. Pay Postman only \$2.50 plus postage. (Send full cash if outside U.S.) Money Back in 10 days if not delighted. AGENTS WRITE.

CALCULATOR MACHINE COMPANY (Mfrs.)

DEPT. 439 P. O. BOX 1118

CHICAGO, ILLINOIS



Surface coatings of rust or gummy film which accumulate on the machined tables and guides of jig saws, band and bench saws are quickly removed and a new precision-looking finish given to machined surfaces by "spot polishing".

The method is simple. The polishing tool (shown above in the Jacobs chuck) is a section of dowel tipped at the working end with a disc of leather or felt. On this disc is put valve grinding compound or powdered emery in oil. The drill press is run at slow speed and the disc brought into contact with the surface to be polished. A few seconds' contact leaves a smooth, bright spot. By repeating the operation, overlapping the spots, a pattern like that illustrated will be obtained.

## 18 Other Helpful Operations Covered in Detail in New Jacobs Booklet

If you have a drill press or lathe, or are planning on getting one, you will want this book. It covers 19 varied uses for these machines and contains 49 helpful illustrations. It shows how to make the set-ups and, in some instances, tells you how to make the tools themselves.







## Never mind "who done it"—pitch in and help get it down!

**T**HIS IS YOUR UNCLE SAM talking—but I'm going to talk to you like a DUTCH uncle, to keep all of us from going broke.

Ever since the Axis hauled off and hit us when we weren't looking, prices have been nudging upwards. Not rising awfully fast, but **RISING**.

If this keeps up—we're all going to be in hot water.

The government's done a lot to keep prices down. That's what price ceilings and wage controls are for. Rationing helps, too.

But let me tell you this—we're *never* going to keep prices down unless we **ALL** help—**EVERY LAST ONE OF US**.

All right, then. Here are the seven rules we've got to follow as **GOSPEL** from now until this war is over. Not some of them—**ALL** of them. Not some of us—**ALL OF US**, farmers, businessmen, laborers, white collar workers!

**Buy only what you need.** A patch on your pants is a badge of honor these days.

**Keep your OWN prices DOWN.** Don't ask higher prices—for your own labor, your own services, or goods you sell. Resist all pressure to force **YOUR** prices up!

**Never pay a penny more** than the ceiling price for **ANYTHING**. Don't buy rationed goods without giving up the right amount of coupons.

**Pay your taxes willingly**, no matter how stiff they get. This war's got to be paid for and *taxes are the cheapest way to do it.*

**Pay off your old debts.** Don't make any new ones.

**Start a savings account** and make regular deposits. Buy and keep up life insurance.

**Buy War Bonds** and hold on to them. Buy them with dimes and dollars it **HURTS** like blazes to do without.

Start making these sacrifices now—keep them up for the duration—and this country of ours will be sitting pretty after the war . . . *and so will you.*

*Uncle Sam*

## **KEEP PRICES DOWN!**

Use it up • Wear it out  
Make it do • Or do without

This advertisement, prepared by the War Advertising Council, is contributed by this magazine in co-operation with the Magazine Publishers of America.





# Motorists! up to 30% EXTRA MILEAGE

from EACH GAS STAMP with a

## VACU-MATIC

### CARBURETOR *Control*



### FITS ALL CARS

• Vacu-Matic is constructed of six parts assembled and fused into one unit, adjusted and sealed at the factory. Nothing to regulate. Any motorist can install in ten minutes. The free offer coupon will bring all the facts. Mail it today!

### AUTOMATIC SUPER-CHARGE PRINCIPLE

• Vacu-Matic is entirely different! It operates on the supercharge principle by automatically adding a charge of extra oxygen drawn free from the outer air, into the heart of the gas mixture. It is entirely automatic and allows the motor to "breathe" at the correct time, opening and closing automatically.

➔ You can't change gas rationing, but you can make sure that each precious gallon of gasoline is providing you with the maximum mileage of which your car is capable. Now you can get added mileage . . . plus quicker starting and more power! Make this free test. Install a Vacu-Matic on your car and get up to 30% extra mileage on a money-back guarantee.

### PROVEN BY TEST

• In addition to establishing new mileage records on cars in all sections of the country, the Vacu-Matic has proven itself on thousands of road tests and on dynamometer tests which duplicate road conditions and record accurate mileage and horsepower increases. Thousands of motorists now enjoy extra mileage—improved performance with Vacu-Matic.

### AGENTS FREE OFFER ➔

• Vacu-Matic offers a splendid opportunity for unusual sales and profits. Every car, truck, tractor and motorcycle owner a prospect. Valuable territories now being assigned. If you help us introduce it to a friend, you can obtain your own free. Check and mail coupon today.

### Send this Free Offer Coupon

THE VACU-MATIC COMPANY  
7617-888 W. State St., Wauwatosa 13, Wis.

Please send full particulars about VACU-MATIC, also how I may obtain one for my own car FREE. This does not obligate me in any way.

Name.....

Address.....

City.....

State.....

☐ Check here if interested in Agency Proposition.





# ***FIRST AID***

## **FOR THE TANKS**



Hurting at top speed over rough terrain, fighting dust and dirt as well as enemy shell fire, even the toughest of tanks may occasionally call for mechanical first aid.

Dangerously close to the battle lines, gallant crews of skilled technicians follow with their mobile machine shops ready to make emergency repairs on any ailing tank and speed it back into action. And there are not many jobs they can't do in the field, for their equipment is carefully selected to provide the utmost versatility and precision.

An essential tool in the mobile shop is the lathe. We are proud that one of our war-time assignments is to supply South Bend Precision Lathes for these indispensable units in America's motorized army.

### **SOUTH BEND LATHE WORKS**

**SOUTH BEND 22, INDIANA  
LATHE BUILDERS FOR 37 YEARS**